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**MARSHALL ISLANDS:
A STUDY OF DIET AND LIVING PATTERNS**

J.R. NAIDU, N.A. GREENHOUSE, G. KNIGHT, AND E.C. CRAIGHEAD

MASTER

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SAFETY AND ENVIRONMENTAL PROTECTION DIVISION

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J.R. NAIDU, N.A. GREENHOUSE, G. KNIGHT,* AND E.C. CRAIGHEAD**

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Marshall Islands: A Study of Diet and Living Patterns

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Abstract

This study summarizes information on diet and living patterns for the Marshallese. The data was derived from literature, answers to questionnaires, personal observations while living with the Marshallese for periods extending from months to years, and from direct participation in their activities. The results reflect the complex interactions of many influences, such as, the gathering of local foods, the receipt of food aid through programs, such as, school-lunch, typhoon-relief, food distributed to populations displaced as a result of nuclear testing, and in recent times the availability of cash for the purchase of imported foods. The results identify these influences and are therefore restricted to local food diets while recognizing that the living patterns are changing as local food gathering is replaced by other food supplies. The data will therefore provide the necessary information for input into models that will assess the radiological impacts attributable to the inhabitation of the Marshall Islands. It is recommended that this study should be continued for at least two to three years in order to more accurately identify trends in local food consumption and living patterns.

Objective

The goal of this study is the evaluation of dietary and living patterns among the inhabitants of the Northern Marshall Islands. These data will be used as input to the dose estimation models (external and internal) that are being developed for the Marshallese who continue to inhabit or will inhabit areas previously contaminated by radioactive fallout from U.S. Pacific Nuclear tests.

Introduction

This study, by the Safety and Environmental Protection Division (S&EP) of the Brookhaven National Laboratory, is a continuation of work which began in 1974 as part of environmental monitoring programs for Bikini, Rongelap and Utirik. The Northern Marshall Islands Radiological Survey (NMIRS) of 1978 provided an opportunity to carry out a study in extensive detail, since the role of S&EP was devoted exclusively to diet and living patterns. Since then, two of the authors, (G. Knight and J.R. Naidu), have continued the study in order to increase the data base obtained through this work. As pointed out in a prelimi-

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nary report to the NMIRS group, one of the key requirements for reliable data gathering is the isolation of the islanders from the "outside" influence of field trip ships and from scientists conducting environmental or medical studies. This stems from the fact that the Marshallese tend to give such inquiries answers which they think are being sought, rather than to provide the objective information desired. Thus the NMIRS program, wherein three of the authors spent short periods of time in residence at each island, served to provide a basis for comparisons with past observations, and to establish a foundation for subsequent studies following the NMIRS. These studies have now been extended through 1979 and are expected to continue indefinitely.

Methods

A thorough review of all existing literature was performed (1-6). Earlier studies (1,2) had as their goals the quantitative and qualitative assessments of food intake, and the establishment of its nutrient value. However, it became apparent during the current study that the earlier studies suffered from certain unintended biases which were the result of inquiries made during short field trip visits. We have ascertained that these biases can be minimized by utilizing an observer who has become integrated into the local community to the extent that his or her presence has a negligible impact on community life. The authors of this report have spent periods extending from months to years on the various islands in the Marshalls, during which time they have become an integral part of the island communities, partaking of the local food and participating in (as well as observing) community living patterns. On the basis of this experience, the authors developed a questionnaire which was used to generate much of the dietary information presented in this report.

The generalized information presented in the main body of this report represents a synthesis of the direct observations of the authors, and of the survey data from the questionnaire. Most of the detailed information, which forms the basis for these generalizations, pertains to the following: Islands/Atolls studied, specific aspects of island living patterns, seasonal phenomena, types of fish and methods of fishing, edible birds, individual family food consumption patterns, (imported) food subsidy programs, community cooperative store stocks, and statistics on the edible fractions of local foods. All of the above information is included in the Appendices.

The following dietary interview was prepared in an attempt to determine the local diet by posing questions to the islanders themselves. It was taken to a number of communities at Rongelap in Rongelap Atoll, Utirik in Utirik Atoll, Mejit, Ailuk, Wotho, Jabor in Jaliut Atoll, at Killi Island and Majuro.

The questionnaire of the dietary interviews, which is in Marshallese but presented here as a literal English translation, was as follows:

Marshall Islands Dietary Interview

In answering these questions, please answer in respect to those of your family who presently live at your house and in respect to only those who eat with you every day.

How many people of school age or over are in your family and eat with your family every day?

What is the name of the island where you presently live.

- 1) How many mature coconuts do you use to prepare coconut milk to mix into your family's food in a typical week?
- 2) How many mature coconuts do you grate to mix into your family's food in a typical week?
- 3) If you are an adult and 18 years or over, other than the mature coconuts mixed into your family's food, how many other coconuts do you eat in a typical week?
- 4) With respect to your children or brothers and sisters of ages 10 through 18, other than the mature coconuts mixed in the family's food, how many would you expect one of them to eat in a typical week?
- 5) If you are an adult, how many drinking coconuts do you consume in a typical week?
- 6) And if you are an adult, how many of these coconuts that you drink will you also eat the soft meat thereof?
- 7) With respect to your children or younger siblings of ages 10 through 18, how many unripe coconuts would you expect one of them to drink in a typical week?
- 8) And in respect to these children, how many of these unripe coconuts that one of them would drink would you expect him to also eat the meat thereof?
- 9) If you are an adult, how many of the kenawe coconuts (in a similar fashion as pandanus, the entire husk is sucked and chewed and a considerable portion is eaten) do you eat during a typical month?
- 10) In respect to your children or younger siblings from ages 10 to 18, how many of the kenawe coconuts would you expect one child to eat during a typical month?
- 11) How many of the sprouted coconuts do you cook the iu (haustorium) thereof in preparing traditional dishes to be served at family meals in a typical week?
- 12) Other than the iu prepared for the family meals, how many iu do you eat in a typical week?

- 13) In respect to the children, how many iu does one child eat in a typical week?
- 14) If you are a man who makes jekaru (tapped nectar of the coconut flower), how many half-gallon bottles does your family use to drink or mix with the family food each day?
- 15) How many pandanus do you cook and make into pulp to mix with the family food or to preserve into Jankwon in a typical week during pandanus season?
- 16) Other than the pandanus you mash into pulp, how many will you eat yourself?
- 17) In respect to the children, on a typical day how many pandanus does one child eat?
- 18) During breadfruit season, how many of the bukrol or batakatak varieties do you prepare for your family in a typical week?
- 19) How many of the bukrol or batakatak varieties do you use to preserve into bwido to be eaten by your family during a typical year?
- 20) During the season for the mejwan variety of breadfruit, how many do you prepare for your family in a typical week?
- 21) Other than the mejwan you cook for the family, how many of the ripe fruits do you eat in a typical week when this variety of breadfruit is in season?
- 22) In respect to the children, how many of the ripe fruits do you think one child eats in a typical week?
- 23) How many of the mejwan variety of breadfruit do you preserve into jankwon for your family to eat during a typical year?
- 24) Other than the mejwan breadfruit itself, how many nuts of this variety do you eat in a typical week when it is in season?
- 25) In respect to the children, how many nuts of the mejwan do they eat in a typical week when it is in season?
- 26) How many blocks of arrowroot starch (about 10 lbs) do you dig and prepare for your family to eat during a typical year?
- 27) How many (pounds of) fish do you cook during a typical week for your family to eat? (A good sized rijin species weighs about 2 lbs.)
- 28) How many pumpkins do you cook for your family during a typical year?
- 29) How many stalks of starch bananas do you cook for your family during a typical year?

- 30) How many stalks of sweet bananas does your family eat during a typical year?
- 31) If you are an adult, how many papayas do you eat during a typical month?
- 32) In respect to the children, how many papayas would you expect one child to eat during a typical month?
- 33) How many (pounds of) sweet potatoes do you cook for your family during a typical year?
- 34) In respect to any other locally grown foods not previously mentioned, please list the foods and the amount eaten by the family during a typical month or year.
- 35) How many chickens do you kill and prepare for your family during a typical month or during a typical year?
- 36) In respect to wild birds, how many times do you make a meal of them during a typical month or year?
- 37) How many times do you make a meal of pig during a typical month or year?
- 38) How many times do you eat turtle during a typical month or year?
- 39) How many times do you eat lobster during a typical month or year?
- 40) How many times do you eat giant clam during a typical month or year?
- 41) How many times do you eat the various types of ocean snails during a typical month or year?
- 42) How many times do you eat octopus during a typical month or year?
- 43) How many times do you eat the coconut crab during a typical month or year?
- 44) How many times do you eat clams (other than giant) during a typical month or year?
- 45) Please circle the months that breadfruit is in season.

Jan.---
Feb.---
March--
April--
May----
June---
July---
Aug.---
Sept.--
Oct.---

Nov. ---
Dec. ---

46) Please circle the months that pandanus is in season.

Jan. ---
Feb. ---
March --
April --
May ----
June ---
July ---
Aug. ---
Sept. --
Oct. ---
Nov. ---
Dec. ---

The feasibility of obtaining a total profile of a typical diet from an interview stems from the prevailing environmental conditions in which the variety of available foods is quite restricted. There is also a very limited trading economy - both the variety and availability of imported foods being restricted by the limited capital of those who import and retail such goods. Thus the limited availability of cash affects both the variety of traditional foods and the amount of contemporary imports as well. Thus, the typical diet is very "day to day". This makes it possible to obtain relatively accurate estimates on a question and answer basis.

Traditionally, one of the most respected talents is the ability to quickly divide large amounts of local food equitably among large numbers of families at island celebrations. The authors have observed the skill of both men and women at this task. Therefore, due to these environmental, economic and cultural factors, it appears that the islanders themselves may eventually produce more accurate estimates of the foods they eat than those likely to be obtained by outside observations.

A crucial problem for an outside observer is that of finding the "typical" family upon which to base his observations, since individual families consume variable amounts of local foods. Some appear to eat primarily a local diet, while that of others contain many imported foods. An analysis of the individual answers of the interviews shows the scope of this variability. However, observations indicate a large variance about the average which reflects wide variations in personal preferences for foods. This is not to suggest that direct observations, especially if made during a complete 365 day cycle, would not yield significant results - but only that such results could not be considered "average" unless observations of a large number of individuals were made. Such a study would show a "typical maximum" or "typical minimum" diet of such families, due to the fact that they would represent such extremes from the norm that they would stand out to the observer whereas the "typical average" diet of the normal family does not. Therefore an outside observer would have no way of choosing which typical family to observe.

The interview data does not provide the "typical average" of the local food consumed by the islanders of the various communities. Rather they provide estimates which approach the "typical average." An interview of forty-four questions cannot provide a direct and straight forward "typical average" of local food actually consumed. The islanders provide better estimates on food they prepare rather than on food actually eaten. Within the interview, emphasis was placed on the amounts of food prepared for the family on a weekly basis, since this was felt to be the most easily answered question to pose concerning the local diet. Since the Marshallese are by culture food gatherers they know more or less how much food they regularly gather and how much they have to cook to keep their families adequately fed. However, not all the food cooked for the family is eaten. Since there is no refrigeration, an undetermined quantity of left-overs is probably on many occasions wasted or more likely fed to pigs or in some cases chickens. Most families keep a pig or two and at least half the diet of these pigs consists of left-overs. Thus, the present study provides a more usable indication for food cooked but not necessarily eaten by the family.

Another problem in obtaining accurate estimates of food consumption is due to food sharing, which introduces a significant variable into the calculations based on the outside observer and interview methods. Food sharing is a culturally induced readiness to feed not only family members, but anyone present as well. An island society is quite open and islanders roam freely from one house to another at leisure. Thus there is a tendency to prepare a larger amount of food than needed for ones immediate family. The problem then is to estimate the amount of food given away. This is a difficult estimate to make, even for an Islander, as it is by no means a consistent amount. What is known is that the Marshallese cook regular amounts, and that they can provide reasonably accurate estimates on how much they prepare. It is not clear how much of this the family actually consumes. To try and pin the islanders down on this question during an interview is difficult. Every man knows from habit how much food he needs to regularly gather to provide for his family. He can only guess how much of this food he occasionally gives away. It was this circumstance that prompted us to concentrate our interview questions on the amount of food regularly prepared, even though it appears that some portion of this food is given away. In the authors' judgement, it seemed best to start with the most reliable estimates possible, and then to proceed from there with further study and comparison.

It should be noted then that the averages obtained from the answers to the various questions of the interview are in many cases based on food prepared for family members. Such averages are labeled per family member (PFM). They were computed by dividing the total amount of food prepared by all families by the total number of family members associated with the individual adults interviewed. Had each member of the family been interviewed (an obviously important step in future studies) the amount cooked (less the amount wasted) should be roughly equal to the total amount eaten. Thus, the problem of food sharing could have been successfully by-passed. However, due to time limitations, the inability to interview those reluctant to participate, and a concern not to inconvenience the islanders in any way meant that an inclusive study of all family members (which would entail active cooperation at all levels of the government of the Marshall Islands) has yet to be completed.

Therefore, this attempt to seek estimates from the islanders themselves concerning the actual amounts of local foods in their contemporary diet should be used not as a definitive answer to the question of what constitutes the "typical average." Rather it should be regarded as a feasibility study on the possibility of obtaining the desired information in this way. In the authors' judgement, the averages obtained from the interview study represent overestimates. They should be so considered until such time as further study proves them accurate or (more likely) provides representative estimates of food sharing and wastage, which could be folded into the study to provide more accurate consumption estimates. Until such time as the factors involved are more thoroughly understood, the feasibility of obtaining a "typical average" estimate from the interview method is in question. However, the present study establishes an upper limit, which has been confirmed by (a) an estimate of the calorie intake based on calorie value of foods (1, 2), and (b) the quantity of food that is available and is gathered on the islands.

Results

The data obtained from the interviews and observations made by the authors since 1970 suggests that the diet patterns can be divided into three typical categories or communities. These communities have the following characteristics:

Community A:

- a. Maximum availability of local foods
- b. Highly depressed local economy - living within income provided by selling copra
- c. Low population
- d. Little or no ability to purchase imported food

Community B:

- a. Low availability of local foods - except fish (which can form as much as 33% of the total diet as a result of excellent fishing in the area).
- b. Overpopulated - resulting in low per capita availability of local foods.
- c. A good supply of imported foods (supply boat comes in every two to three weeks) along with the availability of jobs.

Community C:

- a. Low availability of local foods, even the fishing is poor
- b. Large government food program

c. Overpopulated

d. A good supply of imported foods and availability of cash to buy them.

The results of the interviews and observations are therefore categorized according to the three communities defined above and are tabulated as follows:

Table - 1: For Community A indicating the quantities of local foods consumed

Table - 2: For Community B indicating the quantities of local foods consumed

Table - 3: For Community C indicating the quantities of local foods consumed

Results and Discussion

One of the most significant results of the dietary interview was the determination of the relative portions of local foods in the islander's diet. Tables 1 to 3 show that the amounts of local foods prepared and eaten varies considerably in each community, but that the relative proportions of the local foods which are prepared and eaten are strikingly consistent, regardless of the respective availability of imported foods in each of the three communities. With respect to imported foods, Community (A) was chosen on the basis of low availability. All islanders of this community are primarily copra producers and retain their traditional food gathering lifestyle in an area of correspondingly maximum local food availability. Community (B) was chosen because of high availability of imported foods due to the presence of a well stocked co-op store and the proliferation of government jobs. No copra is made at community (B) and as noted elsewhere in the Marshall Islands the development of a "westernized" economy results (primarily due to the limited land area) in a corresponding minimizing of local food availability. Community (C) was chosen for its large food subsidy and the low availability of local foods resulting from high population density. It is assumed that imported foods are highly available at (C), moderately available at (B) and of limited availability at (A). From Tables 1, 2 and 3 it appears that the consumption of local foods is 100% for Community A, 33% for Community B and 25% for Community C, of the total diet (local and imported food). There is a tendency for the islanders to prepare and cook less local food as imported foods become more and more available. Nevertheless, the relative portions of the local foods eaten appear to remain constant regardless of the availability of imported foods either from a "westernized" economy or a food subsidy program. This is dramatically evident when we compare the amount of coconuts (in all stages of growth and in the different modes of preparation) consumed, for example, they constitute: 55% of total local diet in Community (A), 58% in Community (B) and 47% in Community (C). The relative portions of the various other local foods seems only to change significantly due to environmental conditions. For instance, the fishing at community (B) is widely reputed to be the best in the Marshalls. This explains why fish accounts for 36% of the local diet at (B) as compared to 29% at (A); whereas the islanders at (C) (where there exists limited opportunity for fishing) estimate fish to be only 19% of the

local food they prepare for their families to eat. It may therefore be concluded that the local diet is basically quite uniform and that it changes primarily due to environmental conditions. The effect of imported food is not so much to change the elements of the local diet but simply to reduce them proportionately. The only exceptions to this tendency towards proportionate over-all reduction are Jekaru (coconut sap), Mokmok (arrowroot), and Jankwon (preserved mejwan breadfruit and preserved pandanus). This may be due to the intense labor involved in the processing and preparation of these three foods. They appear to be the first traditional foods to be replaced from a total local food diet by imported sugar, rice and flour. However, further studies are needed to conclusively demonstrate this.

With respect to community (A) where estimates showed the food prepared and eaten to be nearly 100% of the total diet, it is clear that these estimates exceed the actual amount that could conceivably be consumed, even by all the family members. This is especially so considering the fact that this group of family members includes women and children who could not possibly consume all that food on a daily basis when we know that they are eating significant quantities of imported foods as well.

Table 4A and 4B represent a typical maximum diet. It represents the most conservative estimate on the total gram weights of the various local foods which could conceivably be consumed under the assumption of a 100% local diet.

These estimates are based on the assumption that all the Marshallese living on outer islands regulate their dietary habits to a certain extent to a pattern parallel to environmental conditions and the natural food gathering cycles that are governed by these conditions. It is based on a general observation that most islanders do eat local foods. These estimates also indicate how much of a particular food is eaten (by a typical adult and child) during a given foods' peak season or seasons. They do not consider those periods when a particular food is scarce or otherwise difficult to obtain. Since these estimates are based on a cycle of one year, it seems reasonable to assume that this method could provide an estimated maximum. It has also the advantage of being based on principles and assumptions which are scientifically verifiable. The various growing seasons are subject to yearly change. Also the length and production of each growing season varies somewhat from year to year. In calculating the maximum diet the tabulations reflect a somewhat higher percentage of jekaro, coconut and pandanus than could reasonably be expected.

It should be noted that an individual existing totally on such a diet would have to be carrying out a very active food gathering existence, and would therefore have very little time for other endeavors. In short, he would have to return to the premodernized state his ancestors were living 200 years ago. It should also be noted that a higher maximum consumption of any one type of food is conceivable though it would be unlikely for two reasons. One, is the fact that the premodern Marshallese society as well as the contemporary society is very communal in its food consumption patterns. This means that food sharing is extremely important, and therefore if any one person gathers a great deal of any one particular type of food, he is more likely to divide it up and give it away

Table 1: Community A

| Interview Question No. | grams/ weeks | No. of weeks | grams/ yr | Marshallese name for food | English equivalent |
|------------------------------|----------------------------------|-----------------|--------------|---------------------------------|----------------------------------|
| 1 | 192 | 52 | 9984 | el | coconut grated for coconut milk |
| 2 | 480 | 52 | 24960 | Waini | coconut ripe for copra |
| 3 | 1248 | 52 | 64896 | Waini | coconut ripe for copra |
| 4 | 1104 | 52 | 57408 | Waini | coconut ripe for copra |
| 5 | 7199 | 52 | 374348 | drenin ni | coconut water |
| 6 | 1820 | 52 | 94640 | Medi | tender coconut meat |
| 7 | 6440 | 52 | 334880 | drenin ni | coconut water |
| 8 | 2197 | 52 | 114244 | Medi | tender coconut meat |
| 9 | 160 | 52 | 8320 | Kenawe | coconut variety-can be eaten raw |
| 10 | 230 | 52 | 11960 | Kenawe | coconut variety-can be eaten raw |
| 11 | 1380 | 52 | 71760 | iu | coconut 'apple' |
| 12 | 2340 | 52 | 121680 | iu | coconut 'apple' |
| 13 | 1740 | 52 | 90480 | iu | coconut 'apple' |
| 14 | 2646 | 52 | 137592 | Jekaru | nectar from coconut bud |
| 15 | 225 | 52 | 11700 | Jankwon | pandanus pulp |
| 16 | 4158 | 12 | 49896 | Bob | pandanus |
| 17 | 4326 | 12 | 51912 | Bob | pandanus |
| 18 | 2500 | 11 | 27500 | Batakatak or | breadfruit different variety |
| 18 | 1500 | 11 | 16500 | (Bukrol) | breadfruit different variety |
| 19 | 2000 | 15 | 30000 | (Bukrol) | breadfruit different variety |
| 20 | 1496 | 12 | 17952 | Mejwan | breadfruit with seeds |
| 21 | 720 | 6 | 4320 | Mejwan | breadfruit with seeds |
| 22 | 315 | 6 | 1890 | Mejwan | breadfruit with seeds |
| 23 | 300 | 10 | 3000 | Mejwan | breadfruit with seeds |
| 24 | 248 | 6 | 1488 | Kole Nut | seeds of breadfruit |
| 25 | 263 | 6 | 1578 | Kole Nut | seeds of breadfruit |
| 26 | 278 | 7 | 1946 | mokmok | arrowroot |
| 27 | 3084 | 52 | 160368 | ik | fish |
| 28 | | | 2000 | punki | pumpkin |
| 29 | | | 7500 | binana | banana |
| 30 | weekly consumption not possible | | 7500 | binana | banana |
| 31 | | | 12120 | kanapu | papaya |
| 32 | to determine as such only annual | | 12600 | kanapu | papaya |
| 33 | | | 364 | potato | sweet potatoe |
| 34 | figures given. | | 7182 | local vegetable foods | local vegetable foods |
| 35 | | | 500 | bao lol | poultry |
| 36 | | | 2037 | bao lin | wild bird |
| 37 | | | 850 | pik | pork |
| 38 | | | 1000 | won | turtle |
| 39 | | | 500 | wor | lobster |
| 40 | | | 750 | kabor | giant clams |
| 41 | | | 11400 | jerol | snails |
| 42 | | | 913 | kwid | octopus |
| 43 | | | 4500 | barolab | coconut crab |
| 44 | | | 2150 | clams | clams (small) |

Table 2: Community B

| Interview Question No. | grams/ weeks | No. of weeks | grams/ yr | Marshallese name for food | English equivalent |
|------------------------------|----------------------------------|-----------------|--------------|---------------------------------|----------------------------------|
| 1 | 49.4 | 52 | 2569 | El | coconut grated for coconut milk |
| 2 | 264 | 52 | 13728 | Waini | coconut ripe for copra |
| 3 | 216 | 52 | 11232 | Waini | coconut ripe for copra |
| 4 | 144 | 52 | 7488 | Waini | coconut ripe for copra |
| 5 | 3611 | 52 | 187772 | drenin ni | coconut water |
| 6 | 702 | 52 | 36504 | Medi | tender coconut meat |
| 7 | 2300 | 52 | 119600 | drenin ni | coconut water |
| 8 | 416 | 52 | 21632 | Medi | tender coconut meat |
| 9 | 0.25 | 52 | 13 | Kenawe | coconut variety-can be eaten raw |
| 10 | 0.5 | 52 | 26 | Kenawe | coconut variety-can be eaten raw |
| 11 | 350 | 52 | 18200 | iu | coconut 'apple' |
| 12 | 700 | 52 | 36400 | iu | coconut 'apple' |
| 13 | 830 | 52 | 43160 | iu | coconut 'apple' |
| 14 | - | - | - | jakaru | nectar from coconut bud |
| 15 | 1200 | 13 | 15600 | Makon (jankwon) | pandanus pulp |
| 16 | 2688 | 13 | 34944 | Bob | pandanus |
| 17 | 1680 | 13 | 21840 | Bob | pandanus |
| 18 | 450 | 12 | 5400 | Bukrol or | breadfruit different variety |
| 19 | - | - | 1750 | Batakatak | breadfruit different variety |
| 20 | 245 | 12 | 2940 | Mejwan | breadfruit with seed |
| 21 | 380 | 8 | 3040 | Mejwan | breadfruit with seed |
| 22 | 272 | 8 | 2176 | Mejwan | breadfruit with seed |
| 23 | - | - | - | Mejwan | breadfruit with seed |
| 24 | 18.3 | 8 | 146 | kole nut | seeds of breadfruit |
| 25 | 40.8 | 8 | 326 | kole nut | seeds of breadfruit |
| 26 | - | - | - | mokmok | arrowroot |
| 27 | 1364 | 52 | 70928 | ik | fish |
| 28 | - | - | - | punki | pumpkin |
| 29 | - | - | 2800 | binana | banana |
| 30 | - | - | 4000 | binana | banana |
| 31 | weekly consumption not possible | - | - | kanapu | papaya |
| 32 | to determine as such only annual | - | - | kanapu | papaya |
| 33 | - | - | - | potato | sweet potatoe |
| 34 | figures given. | - | - | local vegetable foods | local vegetable foods |
| 35 | - | - | 1200 | bao lol | poultry |
| 36 | - | - | 3250 | bao lin | wild birds |
| 37 | - | - | 500 | pik | pork |
| 38 | - | - | 41 | won | turtle |
| 39 | - | - | 50 | wor | lobster |
| 40 | - | - | 4250 | kabor | giant clam |
| 41 | - | - | 4250 | jerol | snails |
| 42 | - | - | 7125 | kwid | octopus |
| 43 | - | - | 350 | barolab | coconut crab |
| 44 | - | - | 1075 | clams | clams (small) |

Table 3: Community C

| Interview Question No. | grams/ weeks | No. of weeks | grams/ yr | Marshallese name for food | English equivalent |
|------------------------------|----------------------------------|-----------------|--------------|---------------------------------|----------------------------------|
| 1 | 874 | 52 | 45448 | El | coconut grated for coconut milk |
| 2 | 264 | 52 | 13728 | Waini | coconut ripe for copra |
| 3 | 312 | 52 | 16224 | Waini | coconut ripe for copra |
| 4 | 336 | 52 | 17472 | Waini | coconut ripe for copra |
| 5 | 2139 | 52 | 111228 | drenin ni | coconut water |
| 6 | 936 | 52 | 48672 | Medi | tender coconut meat |
| 7 | 1035 | 52 | 53820 | drenin ni | coconut water |
| 8 | 286 | 52 | 14872 | Medi | tender coconut meat |
| 9 | 12.5 | 52 | 650 | Kewane | coconut variety-can be eaten raw |
| 10 | 55 | 52 | 2860 | Kewane | coconut variety-can be eaten raw |
| 11 | 100 | 52 | 5200 | iu | coconut 'apple' |
| 12 | 460 | 52 | 23920 | iu | coconut 'apple' |
| 13 | 240 | 52 | 12480 | iu | coconut 'apple' |
| 14 | - | - | - | jekaru | nectar from coconut bud |
| 15 | 200 | 13 | 2600 | Mokon (jankwon) | pandanus pulp |
| 16 | 1806 | 13 | 23478 | Bob | pandanus |
| 17 | 1680 | 13 | 21840 | Bob | pandanus |
| 18 | 800 | 12 | 9600 | Bukrol or | breadfruit different variety |
| 19 | | | 3300 | Batakatak | breadfruit different variety |
| 20 | 408 | 12 | 4896 | Mejwan | breadfruit with seeds |
| 21 | 225 | 8 | 1800 | Mejwan | breadfruit with seeds |
| 22 | 225 | 8 | 1800 | Mejwan | breadfruit with seeds |
| 23 | - | - | - | Mejwan | breadfruit with seeds |
| 24 | 56 | 8 | 448 | kole nut | seeds of breadfruit |
| 25 | 42 | 8 | 336 | kole nut | seeds of breadfruit |
| 26 | - | - | - | mokmok | arrowroot |
| 27 | 590 | 52 | 30680 | ik | fish |
| 28 | | | 1700 | punkin | pumpkin |
| 29 | | | 2800 | binana | banana |
| 30 | weekly consumption not possible | | 3200 | binana | banana |
| 31 | | | 1320 | kanapu | papaya |
| 32 | to determine as such only annual | | 2880 | kanapu | papaya |
| 33 | | | - | potato | sweet potatoe |
| 34 | figures given. | | - | local vegetable foods | local vegetable foods |
| 35 | | | - | bao lol | poultry |
| 36 | | | 200 | bao lin | wild bird |
| 37 | | | 250 | pik | pork |
| 38 | | | 125 | won | turtle |
| 39 | | | 150 | wor | lobster |
| 40 | | | - | kabor | giant clams |
| 41 | | | 5325 | jerol | snails |
| 42 | | | 1013 | kwid | octopus |
| 43 | | | 638 | barolab | coconut crab |
| 44 | | | 1950 | clams | clams (small) |

[illegible]

TABLE 4A: MAXIMUM DIET FOR LOCAL FOODS - FOR ADULT MALES
WEEK NO. STARTING FROM JANUARY AND THEREFORE REPRESENTS SEASONS AS WELL
(CONTINUED)

| Week | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Question No. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | 266 | |
| 2 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | 1610 | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | 6440 | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | 910 | 910 | 910 | 910 | 910 | 910 | 910 | 910 | 910 | 2275 | 2275 | 2275 | 2275 | 2275 | 2275 | 2275 | 2275 | 2275 | 2275 | 2275 | 2275 | 2275 | 910 | 910 | 910 | 910 |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 12 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 13 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | 6300 | |
| 16 | 3280 | 3280 | 3280 | 3280 | 3280 | 3280 | 3280 | 3280 | 3280 | 3280 | - | - | 900 | 900 | - | - | 900 | 900 | 900 | 900 | 900 | 900 | - | 3280 | 3280 | 3280 |
| 17 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 18 | 2350 | 2350 | 2350 | 2350 | 2350 | 2350 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2350 | - | 2350 | - | |
| 19 | - | - | - | - | - | - | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | - | - | - | - | |
| 20 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 21 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 22 | - | - | 400 | - | - | 400 | - | - | 400 | - | 400 | - | - | 400 | - | 400 | - | 400 | - | - | - | - | - | - | - | |
| 23 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 24 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 25 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 26 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 27 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 | |
| 28 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 1250 | - | 1250 | |
| 29 | - | 875 | - | - | 875 | - | - | 875 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 30 | 875 | - | - | 875 | - | - | 875 | - | - | 875 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 31 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | |
| 32 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 33 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | |
| 34 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 35 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 36 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 37 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 38 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 39 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 40 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 41 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 42 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| 43 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |
| Weekly consumption not possible to determine as such only annual figures given. | | | | | | | | | | | | | | | | | | | | | | | | | | |

Weekly consumption not possible to determine as such only annual figures given.

Weekly consumption not possible to determine as such only annual figures given.

Table 4B: Summary of Maximum Diet (Annual Consumption)

| Question No. | Grams/ Week | No. Weeks | Grams/ Year | Marshallese | English |
|--------------|------------------------|-----------|-------------|-----------------------|----------------------------------|
| 1 | 266 | 52 | 13832 | EL | coconut graated for coconut milk |
| 2 | | | | Waini | coconut ripe for copra |
| 3 | 1610 | 52 | 83720 | Waini | coconut ripe for copra |
| 4 | | | | Waini | coconut ripe for copra |
| 5 | 6440 | 36 | 231840 | drenin ni | coconut water |
| 5 | 10465 | 16 | 167440 | drenin ni | coconut water |
| 6 | 910 | 25 | 22750 | Medi | tender coconut meat |
| 6 | 2275 | 27 | 61425 | Medi | tender coconut meat |
| 7 | - | - | - | drenin ni | coconut water |
| 8 | - | - | - | Medi | tender coconut meat |
| 9 | 300 | 52 | 15600 | Kenawe | coconut variety-can be eaten raw |
| 10 | - | - | - | Kenawe | coconut variety-can be eaten raw |
| 11 | - | - | - | iu | coconut 'apple' |
| 12 | 2000 | 4 | 8000 | iu | coconut 'apple' |
| 12 | 2500 | 20 | 50000 | iu | coconut 'apple' |
| 13 | - | - | - | iu | coconut 'apple' |
| 14 | 6300 | 52 | 327600 | jëkaru | nectar from coconut bud |
| 15 | 900 | 8 | 7200 | Makon (jankwon) | pandanus pulp |
| 16 | 3280 | 16 | 52480 | Bob | pandanus |
| 17 | - | - | - | Bob | pandanus |
| 18 | 2350 | 12 | 28200 | Bukrol or | breadfruit different variety |
| 19 | 450 | 15 | 6750 | Batakatak | breadfruit different variety |
| 20 | 3500 | 9 | 31500 | Mejwan | breadfruit with seed |
| 21 | 700 | 5 | 3500 | Mejwan | breadfruit with seed |
| 22 | 400 | 7 | 2800 | Mejwan | breadfruit with seed |
| 23 | - | - | - | Mejwan | breadfruit with seed |
| 24 | 700 | 5 | 3500 | kole nut | seeds of breadfruit |
| 25 | - | - | - | kole nut | seeds of breadfruit |
| 26 | 560 | 14 | 7800 | mokmok | arrowroot |
| 27 | 2200 | 50 | 110000 | ik | fish |
| 28 | 1250 | 4 | 5000 | punki | pumpkin |
| 29 | 875 | 4 | 3500 | binana | banana |
| 30 | 875 | 4 | 3500 | binana | banana |
| 31 | 100 | 52 | 5200 | kanapu | papaya |
| 32 | - | - | - | kanapu | papaya |
| 33 | 100 | 52 | 5200 | potato | sweet potatoe |
| 34 | | | - | local vegetable foods | local vegetable foods |
| 35 | weekly consumption not | | 4375 | bao lol | poultry |
| 36 | | | 1750 | bao lin | wild bird |
| 37 | possible to determine | | 3500 | pik | pork |
| 38 | | | 1750 | won | turtle |
| 39 | as such only annual | | 7000 | wor | lobster |
| 40 | | | 7000 | kabor | giant clam |
| 41 | Figures given. | | 8679 | jërol | snails |
| 42 | | | 5250 | kwid | octopus |
| 43 | | | 7000 | barolab | coconut crab |

rather than consume a large portion of it himself. Second, the acceptance of food offered is also a very important part of the culture, and therefore it would be very difficult for an individual to isolate his food gathering and consumption patterns from those of the society at large. This latter point is especially true for foods which have limited availability, such as, breadfruit, pumpkin, papaya, bananas, potatoes and during certain times, pandanus and fish. Coconuts and jekaru on the other hand can be gathered in significant quantities at all times. It is therefore much more likely that a maximum (a totally local) diet would be based on them.

If it is assumed that Tables 4A and 4B represent the maximum amount of local foods consumed, and that whatever imported food is eaten will have a tendency to displace proportionate amounts of local foods, then in principle a "typical average" diet could be established. This could be done by subtracting the caloric content of imported food from the total calories of local food consumed per year as shown on the maximum table, and then converting the difference to gram weights using calorie to gram conversion factors for the local foods. By using this method, one can derive the typical amount of local food that could be expected to be consumed in addition to the imported food eaten. Table 5 derives this diet pattern and also presents the averages for the different age groups and sexes.

In summary the results of the study establish maximum estimates of the consumption of local foods, based on the amount of local food that an islander living a traditional life and a totally local diet could consume. These estimates could be further refined by the use of calorie conversion factors specific to the Marshall Islanders and specific to the local food they consume. With reference to the contemporary diet or "typical average" we are continuing our study in two ways. One is by the utilization of the interview method in an attempt to determine the full range of local food consumption in combination with studies of food wasting and food sharing. A second is by the determination of the quantity of imported food consumed in these same communities. In other words, we are suggesting a double approach which would attempt to determine the contemporary diet from opposite directions. This could produce either two corresponding figures or more likely, two reliable figures between which the contemporary or "typical average" diet of the islanders in the community in question would lie.

Table 5: Typical Average Diet as a Function of Age and Sex in Comparison to the Maximum Diet (g/yr).

| Question No. | Maximum Diet g/yr. (Table-4) | Male (51-70 yrs.) | | | | | | Marshallese name of Food | English Equivalent | | |
|--------------|------------------------------|-------------------|-------------------|--------------------------------------|--------------------|--------------------|------------------------------|--------------------------|-----------------------|-----------------------|--------------------------|
| | | Male (11-22 yrs.) | Male (23-50 yrs.) | Woman (11-14 yrs.) Child (7-10 yrs.) | Woman (15-22 yrs.) | Woman (23-50 yrs.) | Woman (15+) Child (4-6 yrs.) | | | Child (1-3 yrs.) | |
| 1 | 13832 | 12864 | 12449 | 11066 | 9682 | 9129 | 8299 | 5948 | El | coconut | grated for coconut milk |
| 2 | | | | | | | | | Weini | coconut | ripe for copra |
| 3 | 83720 | 77860 | 75348 | 66976 | 58604 | 55255 | 50232 | 36000 | Weini | coconut | ripe for copra |
| 4 | | | | | | | | | Weini | coconut | ripe for copra |
| 5 | 399280 | 371330 | 359352 | 319420 | 279496 | 261754 | 239568 | 171690 | drenin ni | coconut | water |
| 6 | 84175 | 78293 | 75758 | 67340 | 58923 | 55556 | 50505 | 36195 | Medi | tender coconut | meat |
| 7 | - | - | - | - | - | - | - | - | drenin ni | coconut | water |
| 8 | - | - | - | - | - | - | - | - | Medi | tender coconut | meat |
| 9 | 15600 | 14508 | 14040 | 12480 | 10920 | 10296 | 9360 | 6708 | Kenawe | coconut | variety-can be eaten raw |
| 10 | | | | | | | | | Kenawe | coconut | variety-can be eaten raw |
| 11 | | | | | | | | | iu | coconut | 'apple' |
| 12 | 58000 | 53940 | 52200 | 46400 | 40600 | 38280 | 34800 | 24940 | iu | coconut | 'apple' |
| 13 | | | | | | | | | iu | coconut | 'apple' |
| 14 | 32500 | 304668 | 274201 | 262080 | 229320 | 216216 | 196560 | 140868 | jekaru | nectar from coconut | 'bud |
| 15 | 7200 | 6696 | 6480 | 5760 | 5040 | 4752 | 4320 | 3096 | Makon (jankwon) | pandanus | pulp |
| 16 | 52480 | 48806 | 47232 | 41984 | 36736 | 34637 | 31488 | 22566 | Bcb | pandanus | |
| 17 | | | | | | | | | Bcb | pandanus | |
| 18 | 28200 | 26226 | 25380 | 22560 | 19740 | 18612 | 16920 | 12126 | Bukrol or | breadfruit | different variety |
| 19 | 6750 | 6278 | 6075 | 5400 | 4725 | 4455 | 4050 | 2902 | Batakatak | breadfruit | different variety |
| 20 | 3500 | 29295 | 28350 | 25200 | 22050 | 20790 | 18900 | 13545 | Mejwan | breadfruit | with seed |
| 21 | 3500 | 3255 | 3150 | 2800 | 2450 | 2310 | 2100 | 1505 | Mejwan | breadfruit | with seed |
| 22 | 2800 | 2604 | 2520 | 2240 | 1960 | 1848 | 1680 | 1204 | Mejwan | breadfruit | with seed |
| 23 | | | | | | | | | Mejwan | breadfruit | with seed |
| 24 | 3500 | 3255 | 3150 | 2800 | 2450 | 2310 | 2100 | 1505 | kole nut | seeds of breadfruit | |
| 25 | | | | | | | | | kole nut | seeds of breadfruit | |
| 26 | 7840 | 7291 | 7056 | 6272 | 5488 | 5174 | 4704 | 3371 | mokmok | arrowroot | |
| 27 | 110000 | 102300 | 99000 | 88000 | 77000 | 72600 | 66000 | 47300 | ik | fish | |
| 28 | 5000 | 4650 | 4500 | 4000 | 3500 | 3300 | 3000 | 2150 | punki | pumpkin | |
| 29 | 3500 | 4650 | 3150 | 2800 | 2450 | 2310 | 2100 | 1505 | binana | banana | |
| 30 | 3500 | 3255 | 3150 | 2800 | 2450 | 2310 | 2100 | 1505 | binana | banana | |
| 31 | 5200 | 4836 | 4680 | 4160 | 3640 | 3432 | 3120 | 2236 | kanapu | papaya | |
| 32 | | | | | | | | | kanapu | papaya | |
| 33 | 5200 | 4836 | 4680 | 4160 | 3640 | 3432 | 3120 | 2236 | potato | sweet potatoe | |
| 34 | | | | | | | | | local vegetable foods | local vegetable foods | |
| 35 | 4375 | 4069 | 3938 | 3500 | 3063 | 2888 | 2625 | 1881 | bae lol | poultry | |
| 36 | 1750 | 1628 | 1575 | 1400 | 1225 | 1155 | 1050 | 753 | bae lin | wild bird | |
| 37 | 3500 | 3255 | 3150 | 2800 | 2450 | 2310 | 2100 | 1505 | pik | pork | |
| 38 | 1750 | 1628 | 1575 | 1400 | 1225 | 1155 | 1050 | 753 | won | turtle | |
| 39 | 7000 | 6510 | 6300 | 5600 | 4900 | 4620 | 4260 | 3010 | wor | lobster | |
| 40 | 7000 | 6510 | 6300 | 5000 | 4900 | 4620 | 4200 | 3010 | kabor | giant clam | |
| 41 | 6679 | 8071 | 7811 | 6943 | 6075 | 5728 | 5207 | 3732 | jerol | snails | |
| 42 | 5250 | 4883 | 4725 | 4200 | 3675 | 3465 | 3150 | 2258 | kwid | octopus | |
| 43 | 7000 | 6510 | 6300 | 5600 | 4900 | 4620 | 4200 | 3010 | barolab | coconut crab | |
| 44 | - | - | - | - | - | - | - | - | clams | clams (small) | |

List of Local Foods and Conversion Factors

- 1) Coconut milk - el - One nut produces 38 grams of milk¹ at 2.6 cal/g.² A solution produced by squeezing freshly grated coconut. Often water is mixed with the coconut gratings to enhance the extraction process. Coconut milk can be used to enrich all traditional dishes and is normally mixed into food before cooking. EL is produced from waini (the mature nut).
- 2) Coconut meat - waini - one nut = 240 grams³ at 3.1 cal/g.⁴ (12 months stage). Often grated and mixed into food but more often eaten as a side dish with breadfruit or fish.
- 3) Coconut water - dren in ni - 230 grams/nut at .109 cal/gram.⁵ The water of the immature coconut at its 7 to 9 month stage is consumed by islanders of all ages regularly when available. The ni must be cut from the tree as opposed to waini which falls by itself. Certain varieties of ni are preferred among others for regular drinking, some varieties being seldom or never consumed.
- 4) Coconut Flesh - medi - 130 grams/nut at 1 cal/gram.⁶ Medi is the soft flesh which forms inside the shell of the ni stage. It is seldom used in cooking and eaten primarily as an in between meal snack.
- 5) Kenawe - 100 grams/nut at .109 cal/gram. Kenawe comes from a particular variety of coconut palm of which the immature, 3 to 5 month stage fruits are sweet to the taste and edible. The shell is soft at this stage and eaten like raw cabbage. The husk in its upper portion at the eye is also edible. The lower portions of the husk are chewed and the juice sucked and then these portions are discarded. Both gram weight and calorie content listed above are estimates as no data on kenawe have been published.
- 6) Sprouted embryo - iu - 100 grams/nut at .78 cal/gram.⁷ The embryo begins to form around the 15th month of the waini stage, and normally takes two to three months to sprout. When the sprouted nuts are used in copra making the iu is first removed before the nut is set out to dry. It is often cooked in a pot with flour and coconut milk. Sometimes it is baked still within the shell. More often it is simply eaten raw mixed with sugar water or jekaru as a meal or plain as a snack.
- 7) Jekaru - .45 cal/grams.⁸ Jekaru is the sap of the tree tapped from the flower while still at the bud (4 week) stage. Up to one gallon of Jekaru can be produced from one tree per day. Jekaru is used as a sweetener in cooking and it is drunk by children and adults fresh in a solution of 50% water. Fermentation begins immediately. It is often boiled and given to babies as a substitute of mother's milk. Unless the fermentation process is arrested it turns into a wine by about 36 hours. Fresh jekaru is often boiled into a syrup called Jekami.
- 8) Pandanus (preserved) - Jankwon - 9.93 cal/gram.⁹ Jankwon is produced by mashing the cooked pandanus keys into mokon, straining out the fibers which were loosened from the cores in the process, baking the resulting mash into

a deep brown paste like substance and drying this under the sun until it is dehydrated to the point where preservation is possible. It is then wrapped in dry pandanus leaves and tied into a neat roll until needed.

- 9) Pandanus keys - bob. There are two basic types of pandanus. One is used to mash into mokon and averages about 50 grams per key;¹⁰ another type is seldom cooked, contains little pulp and only about 30 grams of juice. This latter type is typically eaten raw by chewing and sucking and then discarding the inedible core. There are about 40 keys to a stalk. No known reliable calorie comparison factors for this latter type of pandanus key exist so we have used .58 calories/g.¹¹ for both types has been assumed even though this is an overestimation for the latter. Depending on location (island/atoll) pandanus is eaten consistently for 4 months.¹²
- 10) Breadfruit - batakatak, bukrol. These are the seedless varieties of breadfruit. They contain about 500 grams of cooked edible portion at 1.3 cal/gram.¹³ Three types of breadfruit are eaten consistently over a period of about 12 weeks per year.¹⁴
- 11) Preserved breadfruit (batakatak and bukrol) - buido - 1.3 cal/gram with one fruit equal to 500 processed grams of buido.¹⁵ The breadfruit is picked in large numbers at the peak of season, skinned, and decored, sliced and soaked within a copra sack in the lagoon for a period of hours or days. The sliced fruits are then mashed and allowed to sit and ferment underground within breadfruit leaves where drainage can take place. Before eating it is often rinsed in fresh water to reduce the salt content.
- 12) Breadfruit (variety with seeds) - Mejwan - 272 grams/fruit at 1.12 calories/gram, cooked and 1.22 calories/gram eaten raw.¹⁶ Mejwan is always cooked in its unripe stage though unlike other varieties of breadfruit when ripe it can be eaten raw. It can also be prepared into Jankwon by baking the ripe fruits and then drying them under the sun. The jankwon so produced contains about 2.83 calories/gram.¹⁷ Mejwan is eaten consistently for about 9 weeks/yr. in its unripe stages and for about 5 weeks/yr.¹⁸
- 13) Breadfruit seeds (from mejwan) - Kole - each nut weighs about 2.5 grams and contains about 1.5 cal/gram.¹⁹ The nuts must be cooked to be eaten, and can be considered as a significant portion of the diet for only about 5 weeks per year.
- 14) Arrowroot - Mokmok - 3.5 calories/gram.²⁰ The tubers are dug up in the winter months when the plant itself dies. They are dumped into a copra sack and rinsed of dirt in the lagoon. They are then grated into pulp which is mixed with salt water and strained to separate the starch out of the solution. The solution containing the starchy material is usually trapped in a canvas lined pit which permits the salt water to seep through the canvas into the sand leaving the chalky starch behind which resembles plaster of Paris. The starch is then wrapped in a towel and hung up to drain and dry. It can then be used in cooking without further processing.

Footnotes for List of Local Foods and Conversion Factors.

1. Murai, Mary. Some Tropical South Pacific Island Foods, University of Hawaii Press, Honolulu, Hawaii, 1958;118.
2. Ibid 118
3. Ibid 52-7. (Murai documents the average weight of the mature coconut at 350 grams. However, as most of the coconut eaten is grated and as only 2/3 of this amount is actually extracted from the shell, we have reduced Murai's figure by 1/3 to 240 grams/nut.)
4. Ibid 52-7
5. Ibid 52-4
6. Ibid 52-4
7. Ibid 52-8
8. Ibid 58.
9. Ibid 76
10. Ibid 67-82
(Murai documents the average edible portion of a pandanus key at 75 grams. There are many dozens of variety of pandanus eaten in the Marshall Islands, however, though the two varieties used in Murai's study happen to be the largest. We feel 50 grams/key for the variety which produces mokon and 30 grams/key for the other type to be more accurate overall average.)
11. Ibid 58
12. See page (5 & 6) of Dietary Interview.
13. Murai, Mary. Some Tropical South Pacific Island Foods, University of Hawaii Press, Honolulu, Hawaii, 1958;24-30.
14. See page (5 & 6) of Dietary Interview.
15. Murai, Mary. Some Tropical South Pacific Island Foods, University of Hawaii Press, Honolulu, Hawaii, 1958;24-30.
16. Ibid 24-30
17. Ibid 24-30
18. See page (5 & 6) of Dietary Interview.
19. Murai, Some South Pacific Island Foods, University of Hawaii Press, Honolulu, Hawaii, 1958;34.
20. Ibid 104.

Living Pattern Study:

The living patterns among the Marshall Islanders vary somewhat from atoll to atoll. However, due to the consistency of an atoll environment and its limited land area, as well as the limitations it presents to economic development, reliable estimates can be produced if based on the average amount of time spent at the various tasks necessary for subsistence. Tables 6, 7, 8 list the time spent in various activities by males (ages 15-50 years), females (ages 15-50 years) and children (ages 6-14 years).

From information provided by the Tobolar Copra Plant which keeps copra production works for the various atolls in the Marshalls, it has been determined that the islanders of Utirik Atoll produced about 113 short tons of copra between the Fall of 1957 to the Fall of 1978. Thus this averages to about 90 lbs./week per person. This copra production represents the output of 48 males from ages 14 to 95. As all of these individuals are not involved in copra production to the same extent, it is estimated that those actually working produced about one bag (between 100 and 125 lbs.) per week. This per capita production at Rongelap seemed to be considerably less, while at Ailuk it proved somewhat more. At any rate copra production - the main island commercial activity - could not possibly exceed that possible during the hours taken for coconut collecting and husking per week which we have used as the basis for island activities estimates. It has been estimated that plantation clearing (for undergrowth) adds another 4 hours per individual per week to inland activities associated with copra production. In addition to copra production, another two hours per day of inland activity has been estimated for food gathering.

This is not to say that some individuals do not spend considerably more than 26 hours/week inland. The apparent range over the entire male population is very broad, with some individuals spending in excess of 40 hours and others as little as 7 or less.

The living patterns of women on the other hand, are noteworthy in the relative lack of inland activity. Some of the younger women are involved in coconut gathering, and, to a limited extent, food gathering. Some of the elderly women are engaged in activities related to handicraft production, (such as gathering of pandanus leaves).

Female activities on the lagoon, at the shoreline and on other small islands of the atoll appear to be an insignificant portion of their living patterns. An exception to this is found only when actual settlement of a small island for copra making purposes takes place. In general, women do not go along on the two to three day trips which the men periodically make for cleaning up of the coconut plantation area.

In respect to male activities in the area of ship repair, a direct relationship was apparent between the number and state of repair of traditional canoes and other vessels and the amount of time spent on the lagoon and at other islands.

Shore time activities for men are primarily limited to fishing with throw nets, long nets and cane poles.

On the other hand children spend long hours playing on the beach and in the sand. It was estimated that as a minimum, they occupy this area during two hours of daily activity.

From the above discussion it can be seen that by far the largest amount of time in the living pattern of the islanders is spent within the village area. During the largest proportion of it (45 to 49 hours), they are involved in child raising, handicraft fabrication and relaxation. Indeed it is a rare instance when one stops at an islander's house to find no one there. Such situations occur only during major celebrations or during the arrival of a trading vessel.

To understand the leisurely pace of life on the outer atolls of the Marshalls, it is perhaps best to pay attention to the subsistence activities, and the life and culture supporting functions which are based upon the coconut palm. The palm has been said to be the mother of Pacific man and truly it is the pillar upon which island life revolves. From the preceding section on diet, it is apparent that by the islanders own estimate, the coconut palm provides from 48 to 58 percent of the food for the traditional as well as the contemporary local diet. Fish, which can also be gathered quickly and in great abundance constitute the second major portion of the diet and the other main support for island life and culture. Together these two items provide from 78 to 84 percent of the local food diet. It is upon the availability of these staples, which the environment provides abundantly, that atoll life, as we know it today was established. Even though many of the subsistence skills which enabled the ancestors of the present islanders to thrive and establish their once self-reliant culture have been lost, and though the islanders can in no sense be considered or expected to be totally self-sufficient in terms of their diet, the local food resource foster and support this leisurely pace of life. They can be expected to turn to it in lean times, when for one reason or another the much preferred rice, sugar and flour imports become scarce or unattainable.

Table 6: Male Activities

(15-50)

| <u>A. Inland activities - (26 hrs./week)</u> | | <u>hrs./week</u> |
|---|-----------|--------------------------|
| 1. Brushing plantation | | 4 |
| 2. Coconut collecting | | 4 |
| 3. Coconut husking | | 4 |
| 4. Food gathering of pandanus, breadfruit, <u>ni, iu, Jekaru</u> | total (A) | $\frac{14}{26}$ |
| <u>B. Activities on lagoon (9 hrs./week)</u> | | |
| 1. Fishing on lagoon | | 7 |
| 2. Inter atoll travel (0-2 hrs.) | total (B) | $\frac{2}{9}$ |
| <u>C. Activities at shoreline (7 hrs./week)</u> | | |
| 1. Fishing at shoreline | total (C) | $\frac{7}{7}$ |
| <u>D. Activities on other island (2 hrs./week)</u> | | |
| | total (D) | $\frac{2}{2}$ (0-2 hrs.) |
| <u>E. Activities in Village area (124 hrs./week)</u> | | |
| 1. Canoe and net making and repair | | 4 |
| 2. Clean up of living area | | 7 |
| 3. Coconut cutting and drying | | 4 |
| 4. Church activities, meetings, celebrations | | 8 |
| 5. Sleeping | | 56 |

Table 6: Male Activities (Cont'd)

(15-50)

| | <u>hrs./week</u> |
|--|------------------|
| 6. Child rearing (and monitoring), handicraft, relaxation | <u>45</u> |
| total (E) | 124 |
| Total (A-E) | 168 |

Table 7: Female Activities

(15-50)

| <u>A. Inland activities (8 hrs./week)</u> | | <u>hrs./week</u> |
|---|-------------|------------------|
| 1. Coconut gathering and splitting, gathering pandanus leaf | total (A) | <u>8</u> |
| B. <u>Activities on lagoon (none)</u> | total (B) | nil |
| C. <u>Activities at shoreline (insignificant)</u> | total (C) | insignificant |
| D. <u>Activities on other islands (insignificant)</u> | total (D) | insignificant |
| E. <u>Activities in village area</u> | | |
| 1. Preparation of food | | 28 |
| 2. Splitting coconut shells and drying | | 4 |
| 3. Clean up of living area | | 7 |
| 4. Washing clothes | | 8 |
| 5. Church activities, meetings and celebrations | | 16 |
| 6. Sleeping | | 56 |
| 7. Child rearing, handicraft, relaxations | | <u>49</u> |
| | total (E) | 160 |
| | Total (A-E) | 168 |

Table 8: Children (ages 6-14)

| <u>A. Inland Activities</u> | | <u>hrs./week</u> |
|--|-------------|------------------|
| 1. Collecting <u>iu</u> , gathering coconuts | total (A) | 10 |
| <u>B. Activities on lagoon</u> | | |
| 1. Inter Atoll travel (0-2 hrs.) | total (B) | 2 |
| <u>C. Activities at shoreline</u> | | |
| 1. Play | total (C) | 10 |
| <u>D. Activities on other islands (0-2 hrs.)</u> | | |
| | total (D) | 2 |
| <u>E. Activities in village area</u> | | |
| 1. School | | 30 |
| 2. Clean up of living area | | 4 |
| 3. Washing clothes or drying copra or household chores, etc. | | 26 |
| 4. Sleeping | | 52 |
| 5. Play and relaxation | | <u>32</u> |
| | total (E) | 144 |
| | Total (A-E) | 168 |

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3. Personal Communication Notes:
 - a. E.E. Held, University of Washington (May 1958)
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5. Robinson, W.L., W.A. Phillips and C.S. Colsher (1977). Dose Assessment at Bikini Atoll. Report #UCRL-51879 Pt. 5. Lawrence Livermore Laboratory, Livermore, California.
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Appendices

- A. Seasons: i. Local foods
 ii. Seasons of the year
- B. Marshallese (local) foods
- C. Other Islands used for food gathering
- D. Data on edible portions of Marshallese foods
- E. Fishes: Types of fishes and methods of fishing
- F. School children - lunch program
- G. Typhoon relief
- H. Food supply ships - trip reports
- I. Private or community stores - types of foods available

Appendix A

SEASON (WOTON) - Local Foods

Pandanus - various observations

| <u>Spokesman</u> | <u>Ripens</u> |
|------------------|---|
| | 1a) June - July, b) November - January |
| Nagal - Ailuk | 2a) June - July, August, September, b) November, December January, February |
| Cement - Ailuk | 3a) April, May, June, July, b) December, January, February |
| Cement - Ailuk | 4) all year June - December |
| Paul - Rongelap | 5) 8 months September/October - April/May |
| Jotai - Rongelap | 6) May, June, July (begins growing January) |
| Ailuk | 7a) June, July, b) November, December, January |
| * | 8) October, December, January but some ripens throughout year in small numbers |
| Henas - Rongelap | 9) December begins to grow/March, April ready to eat |
| Ailuk | 10) January, February, April, May, June, July, August, September |

Comments: during a drought-smaller and smaller fruits

Breadfruit - various observations

| <u>Spokesman</u> | <u>Ripens</u> |
|------------------|---|
| Henas - Rongelap | 1) May, June, July, August, September, (little October) 2a) June, July, b) December, January |
| Nagal - Ailuk | 3) April, May, June, July, August |
| Cement - Ailuk | 4a) June, July, August, September, b) December, January |
| Ailjen - Ailuk | 5a) June, July, b) December, January 6a) summer, b) November, December |
| Rongelap | 7a) July, August, September, b) December, January 8) May - September, peak May through July some be may be present until December |

*Bryan Jr., E. H., Life in the Marshall Islands, p. 129.

SEASON (WONTON) (cont'd)

9) December, January, February, April, May, June, July
(mokan)

Comments: After a breadfruit season, pandanus follows. They alternate seasons.
(Nagat - Ailuk)

Bananas - various observations

Spokesman

Nagal - Ailuk all year around

Hemos - Rongelap all year - more in rainy season

Arrowroot

Spokesman

Hemos - Rongelap November, begins growing, December and January ready to eat

Nagal - Ailuk December, January, February

* October through January

 Rongelap January, February, March, April

Coconut - iu (flowering coconut)

Spokesman

Nagal - Ailuk whenever anybody wants to find and eat it

Pumpkin

Spokesman

Nagal - Ailuk all year

Cement - Ailuk all year

Sue - Rongelap all year

 1 month for pumpkin to become large

*Bryan Jr., E. H., Life in the Marshall Islands, p. 129.

Cement - Ailuk

Pandanus Season - January, February, March, April, May, June, July, August, September

| | <u>Pandanus Types</u> |
|-------------------------|-----------------------|
| First pandanus season | Jablower |
| beginning March-end | Kobarwa |
| of May | |
| Second pandanus season | Lejokrer |
| beginning of June- | Lokotwa |
| end of August | Lebo |
| Third pandanus season | Edmerma |
| beginning of September- | Leomtur |
| end of November | Ailuk |
| | Kemelij |
| | Lemoen |
| Fourth pandanus season | Lekman |
| beginning of January | Lejmou |
| end of March | Liman |
| | Mojel |
| | Wottet |
| | Nibun |

The information given by the Marshallese seems to show two seasons for both breadfruit and pandanus. This is a widely accepted fact and tends to support our own observations made during our extended stay on the islands in the Marshalls. According to the above figures, one would expect that the summer season, which bears the largest crop and is the time when preserving is normally done, begins around the second week of May and continues progressively until July--the month when the preserving is traditionally done and continues on into the second or third week of August. The second or winter breadfruit crop falls in December and January.

It should be noted that the pandanus season is markedly different in the Northern Marshalls where due to lack of rain in the winter months, the summer crop is normally much larger. To some extent, this holds true for breadfruit as well--the winter crop being much smaller.

SEASONS (WONTON) (cont'd)

Taro

Spokesman

Nagal - Ailuk grows all year

OBSERVATIONS ON SEASONS OF YEAR

Summer season of maximum rainfall in the year*

rainy season on Ailuk May, June, July, August; slows down September, October, November, December

Rainfall decreases as you go north
average rainfall: Jaluit - 160" Wake Island 30 to 50"
(350 miles further north)
Majuro - 120"
Ujelang - 80"
Eniwetak - 60 to 70"*

Winter December - April, season of strong winds from the northeast.
Dry period of the year.*

Temperature °F range varies less than 10-12°*
Minimum: 68°
Maximum: 80°

⁴Bryant Jr., E. H., *Life in the Marshall Islands*, p. 135-36.

Appendix B

Marshallese Foods

a: Marshallese names for food types

Local Foods

breadfruit - ma
coconut
 drinking - ni
 copra - waini
 oldest stage - iu (sprouted)
pandanus - bob
arrowroot - mokmok
taro - iaroj
pumpkin - baanke
papaya - keinabbu
banana - pinana
sweet potatoe
coconut sap - jekeru
chicken - bao
pig - piik
turtle - won
fish - ek
clams - kapwor
lobsters - wor
birds - bao
coconut crabs - barulep
eggs - lep
 turtle
 bird
 chicken

Imported Foods

| | |
|-----------------------|------------------------------------|
| rice - <u>rai</u> | sugar |
| flour - <u>pilawa</u> | soy sauce |
| can - <u>kuwat</u> | mayonnaise |
| tuna - <u>bwebwe</u> | yeast |
| chicken - <u>bao</u> | baking powder |
| beef - <u>cow</u> | candy - M&M's, gum, chocolate bars |
| mackerel | coffee |
| cornbeef | tang |
| sardine | tea |
| vienna sausage | milk - Carnation Instant |
| spam | |
| beef hash | |
| biscuits - ship, crab | |
| Ramen soup | |
| peanut butter | |
| kim chee | |
| shortening | |

b: Cooking Modes

- (1) Ground oven - UM - The ground pit is fueled by a coconut shell or husk fire. Rocks are then added to cover the coals. When the rocks have been warmed the food is placed in. The pit is covered over with banana leaves, canvas or a heavy rubber sheet. Weights are added.
- (2) Stove Type Cooking - is always done either over a kerosene stove or an open fire fueled by coconut shells or husks.
 - a) boiling - using rainwater, brackish water when rainwater supply is low.
 - b) frying - using Crisco, other shortenings, occasionally pig grease, rarely if, ever coconut oil.
 - c) steamed -
- (3) Roasting - is done over a coconut shell or husk fueled fire, when it has turned to coals.

c: Description of the Food Types

1. Breadfruit - MA

- (1) Kwanjin - green breadfruit roasted on coals until skin is black. The outside is then scraped with pieces of broken glass or shell. Approximately 1½ hours to cook.
- (2) Steamed - fill the iron pot with water up to metal disk. Cooking time varies according to type being cooked.
 - a) bwiro - 2 hours to steam on fire
 - b) raw breadfruit (whole) 30 minutes by stove
- (3) Boiled - wash green breadfruit leave whole and boil.
- (4) Kopjar - baked breadfruit in ground oven.
- (5) Jokkwapin Ma - Breadfruit soup is made by removing the core and skin, cutting the rest into pieces which are boiled, mashed, mixed with coconut milk and salted to taste.
- (6) Fried - Cut the ripe breadfruit into slices removing the outer green peel. Soak the wedges in salt water or salt them before frying. Cooking time approximately 10 minutes on each side until brown or french fried.
- (7) Kalo - very ripe breadfruit mixed with coconut milk.
- (8) Mijiwan - a type of breadfruit which is eaten raw when it is very ripe; as is or with coconut milk.
- (9) Kwolejiped - name of nuts (kwole) cooked. They are roasted on coals or taken out of a steamed, baked, or boiled Mijiwan Breadfruit.

- (10) Bwiro - preserved breadfruit or Marshallese cheese. The skin is removed from the ripe green breadfruits then cut in wedges and placed in a burlap bag and taken to the lagoon. The bag is anchored for one or two days in the saltwater or stomped on for an hour or so to hasten the fermentation. The bag is then taken from the water and left on coconut leaves in the open air for one or two days. The breadfruit is then placed in a pit lined with breadfruit leaves. Leaves, a cloth cover and weights are then placed over the breadfruit. The breadfruit leaves are changed after every month and the bwiro is ready for cooking after two months. Supply can be kept six months to a year or two. (Type of breadfruit used--bakrol, batatak, koutroro.)

Bwiro Food Preparation

The quantity of preserved breadfruit that is needed to cook with is taken from the pit or box and thoroughly washed in fresh water. Coconut milk is then mixed with the rainwater. Sugar is also added along with flour which is optional. A ladle full of the mixture is then placed in a breadfruit leaf and is either steamed, boiled, or baked. Another method of cooking is to roll the bwiro into balls and then steam or boil.

- (11) Baked - The inside stem of a ripe breadfruit is removed and coconut milk replaces it. The breadfruit is then wrapped in leaves and baked.
- (12) Jankwin - Mijiwan seeded breadfruit is picked green; allowed to ripen; seeds, core and skin removed; placed in a coconut leaf basket; baked in earth oven all night; taken out; unwrapped; flattened and allowed to dry in sun. When dry, it is rolled, wrapped in pandanus leaves, tied with sennit twine and preserved as a roll.

2. Coconut

The coconut was traditionally and still in some circumstances continues to be the focal point upon which the Islander's diet revolves. Indeed nothing is found in greater abundance among the atolls than coconut. The tree itself was an important foundation upon which Island life evolved. The leaves being woven into shelters and the fibrous strands of the husk twisted into sennit rope for the lashings of houses and outrigger canoes. The bud-sheath was used as a bowl in which to pour ingredients to bake in ground ovens. Baskets woven from the leaflets of the tree were, and occasionally still are, commonly used for eating and displaying and transporting food.

The coconut fruit requires approximately 12 months to ripen and usually falls off itself after an additional few months due to stem decay. At this stage it is ready to be husked, broken open and dried under the sun or in a smoke-house into copra, the major island export. And at this stage it can be opened and the nut cut from the shell and eaten as jiral (with something else) fish, for instance or breadfruit or both. It has a high oil content however and a two to four ounce portion is seldom exceeded unless there is a scarcity of imported or other local foods. Children seem to eat considerably more of it than adults do. The elderly, on the other hand, especially those lacking teeth, eat it normally only when it is mixed into the family food. Binbin is a term that is used to describe the preparation of a variety of dishes in which mashed banana or tarro or breadfruit or more likely rice, is formed by hand into a ball and rolled over coconut gratings which stick to the surface and help preserve its shape. These gratings are produced in a process called ranke whereby the nut is scraped from its shell by a rounded, tooth edged blade normally screwed onto a stool on which one can sit while engaged at the grating or ranke process.

The water of the mature coconut or waini is sometimes drunk. More often, however, it is mixed with food as an ingredient before cooking or not being as sweet or flavorful as the water in the unripe nuts discarded altogether. The earliest stage at which the water begins to sweeten and is used for drinking is termed obleb--around its sixth month of growth. The shell is still soft enough to break with the fingers and the nut itself--if it has started to form at all--is but a thin gelatin lining the bottom of the shell that can be loosened with a thumbnail and drunk. The next stage when the gelatin hardens as does the shell allowing itself to be husked is called ni. This is the stage at seven to nine months when the nut is normally used for drinking. During this period, the nut continues to form though its texture remains soft and removable from the shell by the thumbnail. When it becomes too hard for this and begins to become cemented to its shell at around nine to ten months, it is called mejjob. The meat of the nut is hard though not quite as hard as in the mature, waini, stage and not as oily. Mejjob is seldom eaten today though it was in the past and may one day again be a staple to ward off hunger in times of famine. This is due to its abundance and to the fact that the lower oil content allows for a larger quantity to be eaten before bringing distress to the bowel. It can be grated by the ranke process and is sometimes used in this way mixed as an ingredient into food or put in a bowl with jekaro and eaten as a sort of cereal called jekbwa.

Jekaro is a nectar collected by binding and repeatedly (morning and evening) cutting the budding composit flower of the coconut tree. As the tree produces one bud a month and as a bud can be tapped for a period of up to four months, a good

tree can have up to four bottles containing up to a gallon of jekaro hanging and waiting to be collected each morning. The tree will produce a similar quantity that must be collected in the evening. It is very sweet and is usually mixed with water for drinking and very nutritious, especially after four to six hours at which point the yeast content is greatest. After this it begins to become noticeably alcoholic and at 36 hours when the fermentation process stops, it can be drunk as a wine. In its sweet, unfermented stage it has been used as a substitute for mother's milk. When available, it can be used as a sweetener in any or all of the traditional dishes. When it is boiled down, it yields on an eight to one ratio a delicious syrup termed jekami which is used as a sweetener in drinking and also eaten with coconut at its various stages. It can be mixed and further cooked with coconut gratings to produce a type of coconut candy, much prized, called amitama.

At around the 15th to 18th month, the coconut begins to sprout. At this time, the inside of the nut turns gradually to a sweet apple-like, spongy substance called iou. A side product in copra making, it is eaten in the interior islands by those gathering the nuts. Then again eaten by those while husking. When the nuts are cracked, children flock to the area to scoop out the soft iou before the nuts are layed out under the sun. Iou is sometimes crushed and mixed raw with jekaro and thickened with flour into a pudding--aikiou. Also it can be steamed or baked in a basket (iutur) or even while still in the nut (umum ilo lot).

To the aikiou dish el is often added. Indeed it is through the el or famous "coconut milk" that the coconut can be seen as the central ingredient in all traditional cooking. El is obtained by mixing the grated coconut or waini with a little water and squeezing. Much of the oil and a great deal of flavor is thereby released into solution--pure white in color. El can, and often is, mixed into every dish conceivable. When available, it is normally mixed into the rice on a daily basis at the rate of about one coconut per two cups of rice.

Coconut - ni

ni - 1 to 5 months growth

- 1) young drinking
method - drink through hole in husk, shell too fragile to husk, gelatinous coconut meat
- 2) mature drinking coconut
method - husk coconut before drinking coconut meat firm, use knife to cut from side
- 3) waini - 6 to 7 months growth

copra-producing coconut
use of liquid - usually thrown away, children drink occasionally
use of meat - eaten a) cut in wedges-with fish or by itself
b) grated and squeezed for coconut milk
c) use gratings in cooking, rice balls, moka
- 4) iu - 8 to 8 1/2 months growth
spongy food inside sprouted coconut
use of iu a) eaten raw
b) cut up and boiled with sugar or jekeru
c) cut up and boiled with flour, sugar or jekeru
d) raw iu cut up and sweetened with sugar or jekeru
e) iuwumum - spongy meat of sprouted coconut baked in its shell
f) iutir - baked spongy meat

Food from coconut. sap

jekeru - sap from coconut blossom

- uses - a) drinking
b) used as a sweetener in place of sugar, i.e., donuts, bread

jakamai - boiled jekeru into a syrup

- uses - a) used mixed with cold or hot water as a drink
b) used for pancake syrup
c) used as a sweetener

amedama - jakamai syrup mixed with grated coconut rolled in a ball - coconut candy

coconut milk - produced from waini

method of extracting grated coconut from coconut meat is called roanke.

Then coconut milk is squeezed out of these coconut gratings.

- uses - rice - Coconut milk squeezed into water at start of cooking.
Amount - coconut milk squeezed from one or two grated coconuts per 500 g of rice.

moka - cooked pandanus meat that has been removed from the key (kilok)

- a) coconut milk added to mokanas as gravy

gravy - with clams, fish, breadfruit, pumpkin, used with all foods available.

3. Pandanus

The Pandanus fruit resembles a huge pineapple at superficial external glance. However, a closer inspection shows it to be made of large, individually extractable kernels surrounding a central inedible core, much like corn does on its cob. A pandanus fruit can weigh up to thirty pounds and consist of up to forty kernels or keys. These keys themselves are stringently fibrous in nature (indeed, a spent and dried key makes an excellent paintbrush), the inner portion of which contains the flavorful though somewhat stringy pulp which when raw has the consistency of a carrot and likewise can be mashed upon being cooked. The bulk of the pandanus fruit and a considerable portion of its weight is attributed to the upper inedible partially external portion or the keys. This external portion, which is particularly fibrous, is capped by a tough and nobby rind.

Pandanus is traditionally a very important staple for the Marshall Islanders, especially among the northern atolls where due to lack of sufficient rainfall depend less on Breadfruit, taro, bananas and papayas than do those Islanders living in the southern Marshalls. All over the islands it is eaten when ripe uncooked and in sufficient quantity to be considered a staple. Because of its availability throughout the interior of most islands and because it grows on even the distant unpopulated islands on all atolls, it is often used to ward off hunger during copra harvesting, brushing, fishing and inter-atoll travel. It is considered to offer relief from "morning sickness" and is sought by pregnant women who often eat tremendous quantities of it. Said to be good for sea-sickness it is piled onto vessels of all types and destinations and eaten by nearly everyone aboard during the entire length of the trip. The fact that it can be knocked about a great deal without danger of spoilage (due to its particularly tenacious rind) makes it especially suitable for inter-atoll export where it brings a good price in the district center and on Ebeye.

There are many different varieties of pandanus, some of which are always eaten raw. Others are normally boiled, steamed or baked in a ground oven before eating or processing because they are more starchy, very difficult to chew in their raw state and much more tasty and in particular sweeter after being cooked. These later are the varieties used in the preparation of mokon--the mashed pulp once it has been separated by mechanical means from the fibrous core using an apparatus called the bakan--in the process called kilok. Cooking allows pandanus to be eaten even in its unripe stages though generally speaking the more ripe the fruit the more mokon is produced in the kilok process. The varieties of pandanus are seemingly endless. Each variety has a characteristic shape, consistency, and flavor.

Jankwon is prepared from mokon by baking it to further reduce its water content and then by spreading it out usually on leaves to dry in the sun. The final product is then traditionally wrapped in pandanus leaves and tied with sennit. Though jankwon production is nearly a lost art over much of the Marshalls, it is still continued among the northern atolls, including Rongelap and Utirik where it is apparently a more firmly rooted tradition.

Pandanus - bob

fresh - eat when ripe or uncooked

eroum - boiled pandanus

bake - bake keys in ground

peru - Pandanus pulp and juice mixed with grated coconut and coconut oil and optionally with arrowroot starch, wrapped in breadfruit leaves and boiled or baked.

mokan - The pudding from a cooked pandanus key. The food is removed from the key by a process known as kilok. The cooked pulp is then mixed with other foods or eaten as is.

Examples: a) often mixed with grated coconut
b) mixed with coconut milk
c) served with fish
d) by itself as a dessert

jankwin - Cooked pandanus, extract from keys keys--mokkay, dry in sun, wrap in pandanus leaves and tie with sennit twine.

unripened pandanus - mashed with sugar or jekeru and water.

4. Arrowroot - mokmok

The arrowroot is dug up from the oceanside of the island, placed in a burlap bag, and washed until white. Each separate piece is then grated with a rock. The arrowroot is placed in a wanliklik made of sennit (from fibers of coconut husk) used for straining arrowroot starch. It is then rinsed with two buckets of saltwater. The arrowroot powder is then saved from the canvas or wanliklik, wrapped in a cloth and tied in a tree to dry. The powder is then removed from the cloth (bag), dried in the sun and then stored for future use.

ways of cooking - a) boiling with waini
b) Beru Pandanus and mokmok

5. Taro - iaraj

Stem and leaves are cut off and the remaining root and sugar (optional) added to boiling water. Cook one hour.

The root is also baked.

6. Fruit - kwale

banana - binana

when consumed and cooking method a) eaten when ripe
b) baked, when not ripe
c) fried
d) boiled in skin
e) mashed and mixed with coconut milk and coconut syrup, when ripe

papaya - keinabbu

when consumed and cooking method a) raw
b) boiled and added to meat gravy
c) boiled

pumpkin - baanke

when consumed and cooking method a) boiled
b) cooked in gravy
c) with coconut milk

sweet potato

when consumed and cooking method a) baked

7. Meat - kanniok

chicken - hao

eaten: meat, liver, kidney, heart

methods: cleaned, boiled

cleaned, boiled, fried

cleaned, fried

baked (rarely)

gravy - flour, shoyu, pumpkin, ma, keinappu bop

soup rice, same fruits as above

When eaten

special occasions--birthday, Christmas, Easter, parties

made leftover chicken

fish - ek

eaten: most meat on head, eyes, suck on bones

methods: not cleaned - cooked in skin on coals

fried with salt

cleaned, wrapped in coconut leaves - boiled

baked (rarely)

gravy - flour and fruits

soup - rice, fruits

cleaned, salted, dried in sun

fresh or sashmi

salted - 2 days in sun - meat good for 3 or 4 days

fry with coconut milk - stays good for months (preserves)

whenever the man in house goes fishing depending on productive nature of man

Note: one can eat fish for three days if it is cooked everyday

When eaten

-pik
eaten: meat, fat, heart, kidney, brain, suck on bones
methods: fried and skin
 salted
 gravy - flour, shoyu
 baked (rarely)
 boiled - 20 minutes, add seasonings such as
 onions, garlic, vinegar, shoyu, salt
 if available

turtle - won
eaten: meat
methods: baked - most common method of cooking
 fried - when there is grease

special occasions--birthday,
Christmas, Easter, parites
the whole island eats when a
turtle is caught-no special
time

wild birds
eaten: meat, suck on bones
methods: cook on coals
 fry if grease available
 ground oven baking

mostly when overnight on other
island, enroute to other islands,
or special food gathering, trip
made

clams - kapwor - killer clams
methods: boil
 fry
 eat with el - coconut milk

whenever diving for them mostly
in conjunction with fishing

lobsters - war
eaten: tail and legs
methods: cook on coals
 boil

on fishing trips, when full moon
is out and man goes to oceanside
to get it.

coconut crab - barulep
eaten: tail, claws
methods: cook on coals

on fishing trips, overnights

Eggs

wild bird eggs
method: boil

Easter time and when special food
gathering trips may have been made

chicken eggs
methods: boil
 fry
 used in other cooking
 ground oven baking

not eaten much, reserved for
production of chickens; eggs,
generally thought to be for sick
and pregnant people

turtle eggs
methods: boil

eaten when found - usually no
special trip is made to get them

8. Rice

Rice is cooked with coconut milk (el) which has been squeezed from coconut gratings. These gratings come from the copra producing coconut (amounts-one or two coconuts used per 500 grams of rice.

rice jokkwop - soft rice soup--water, rice flour, sugar, coconut milk

rice balls - cooked rice rolled in balls with grated coconut on outside used on special occasions, size of tennis ball.

9. Flour

bread - yeast
sugar or jekeru - coconut sap
flour
water
shortening

Doughnuts - yeast or baking soda
sugar or jekeru - coconut sap
flour
shortening
water

cakes - flour
baking soda
sugar
water
egg (occasional)
milk

gravy - flour
water
sugar
additional food: pig, chicken fish, pumpkin, papaya, iu)
optional: shoyu
spices

pancakes - flour - 7 cups
shortening - two tablespoons
baking soda
milk - 13 oz. can
water
sugar - 1 cup
eggs - USDA 6 oz. (1 package)

Appendix C
Other Islands Used for Food Gathering

RONGELAP

| No. of Times a Year Frequented | Name of Island | Foods gathered and Copra |
|-----------------------------------|----------------|---|
| 4 | Eniutok | pandanus, breadfruit, coconut crab, iu, fish, turtle and copra *people are apt to stay over while they make copra |
| 2-4 days | Edbot | coconut crab, pandanus, iu, fish, lobster, turtle, coconuts, copra |
| 24 days | Luwataki | pandanus, coconuts, fish, iu, turtle, coconut crab, copra |
| 12 days | Likaman | coconut, iu, pandanus, turtle, coconut crab, copra *people stay over 2 weeks a year |
| 12 days | Arbar | coconut crab, fish, pandanus, iu, turtle, coconuts |
| 12 days | Keruke | fish, iu, coconut crab, arrowroot, turtle, pandanus breadfruit, clam, copra |
| 6 days | Burok | coconut crab, pandanus, breadfruit, fish, iu, turtle, coconuts, copra (but not presently making it) |
| 6 days | Kapelle | coconut crab, pandanus, breadfruit, fish, iu, turtle, coconuts, copra (but not presently making it) |
| 6 days | Naen | fish (reef, lagoon), turtle, eggs, coconut crab, coconuts, copra (but not presently making it) |
| 6 days | Ailañinai | Birds, bird eggs, coconut, coconut crabs, clams, turtle |
| 6 days | Rongerik | birds, birds eggs, coconut, pandanus, turtle, clams |
| 6 days | Malu | no information |
| 4 days | Jokrak | fish, iu, turtle, coconut crab (don't normally eat), birds, eggs |
| 4 days | Einablar | no information |

Note: Now they have five outrigger canoes plus their community boat which they had before (often times not working). They are more mobile now and have more money to use the community boat so these figures are sure to change.

UTERIK

Awan - pigs, iu, breadfruit, pandanus
occasionally drinking coconuts, fish

Bekrak - iu, fish, pandanus, breadfruit, coconuts

Taka - birds, turtles, fish

Bikar - turtles

Nalap - fish, pandanus, coconut

Nate - fish, pandanus

Ellikiki - fish, pandanus, breadfruit, coconuts, coconut trees for planting

Biki - fish, pandanus, breadfruit, coconuts, coconut trees for planting

AILUK

People living on

Ajikik - 2

Ailuk - 250

Enejelar - 35

Enejabrok - 12

Kaben - 8

Bikan - 8

Baojen - 2

Aliej - 2

Akilwe

They go to all of the islands in their atoll to gather food.

Rarely visited: Jaeo, Binajrak, Bikrak, Enen Arno, Bokekan

Fishing only: Marme, Jebamit, Jirankan, Bakanneaken, Alirok, Eense

| <u>Island</u> | <u>Food Gathered</u> |
|---------------|---|
| Kaben | breadfruit, fish pandanus coconuts, pigs coconut crabs arrowroot |
| Enejabruk | |
| Enejelar | |
| Bikon | |
| Ajilep | |
| Aliej | |
| Akulwe* | |

WOTH0

Bigkin - birds }
Anibling - birds } especially during Christmas and other special occasions

Kapen - breadfruit, pandanus

Medron - breadfruit, pandanus

Eneobinek - breadfruit, pandanus

all islands - coconuts, coconut crab, turtle, lobster

Appendix D
Data on Edible Portions of Marshallese Foods

COCONUTS - DRINKING

Rongelap

| <u>Volume (cc)</u> | <u>Meat (g)</u> | <u>Volume (cc)</u> | <u>Meat (g)</u> | <u>Volume (cc)</u> | <u>Meat (g)</u> |
|--------------------|-----------------|--------------------|-----------------|--------------------|-----------------|
| 250 | 100 | 260 | 115 | 480 | 280 |
| 260 | 62 | 300 | 120 | 230 | 90 |
| 500 | 110 | 550 | 240 | 240 | 130 |
| 350 | 152 | 500 | 160 | 370 | 100 |
| 350 | 80 | 350 | 124 | 580 | 220 |
| 300 | 46 | 350 | 80 | 260 | 144 |
| 500 | 130 | 600 | 130 | 260 | 150 |
| 250 | 75 | 350 | 46 | 350 | 125 |
| 230 | 80 | 300 | 130 | | |
| Average | | | | 358 | 124 |
| Standard deviation | | | | +116 | + 56 |

Uterik

| <u>Volume (cc)</u> | <u>Meat (g)</u> | <u>Volume (cc)</u> | <u>Meat (g)</u> |
|--------------------|-----------------|--------------------|-----------------|
| 340 | 100 | 350 | 115 |
| 240 | 80 | 220 | 60 |
| 370 | 125 | 300 | 70 |
| 260 | 110 | 270 | 140 |
| 260 | 115 | 270 | 130 |
| 350 | 130 | 220 | 70 |
| 300 | 110 | 290 | 125 |
| 200 | 60 | 260 | 72 |
| 260 | 115 | 260 | 80 |
| 260 | 125 | 250 | 100 |
| 270 | 140 | 260 | 115 |
| 240 | 125 | 270 | 150 |
| 250 | 110 | 300 | 150 |
| 250 | 125 | 260 | 140 |
| 250 | 130 | 250 | 100 |
| 260 | 110 | 290 | 150 |
| 290 | 135 | 350 | 145 |
| 250 | 110 | 440 | 150 |
| 240 | 100 | 270 | 62 |
| 300 | 150 | 260 | 126 |
| 350 | 130 | 350 | 110 |
| 440 | 140 | 280 | 125 |
| 280 | 125 | | |
| 250 | 105 | | |
| 290 | 130 | | |
| Average | | 283 | 115 |
| Standard deviation | | + 51 | + 26 |

COCONUTS - DRINKING

Ailuk

| <u>Volume (cc)</u> | <u>Meat (g)</u> | <u>Volume (cc)</u> | <u>Meat (g)</u> |
|--------------------|-----------------|--------------------|-----------------|
| 430 | 110 | 430 | 120 |
| 380 | 35 | 620 | 165 |
| 450 | 170 | 450 | 170 |
| 280 | 110 | 240 | 50 |
| 440 | 140 | 330 | 165 |
| 180 | 45 | 370 | 110 |
| 180 | 50 | 450 | 130 |
| 180 | 60 | | |
| 180 | 55 | | |
| 240 | 70 | | |
| 240 | 75 | | |
| 240 | 65 | | |
| 240 | 60 | | |
| 240 | 58 | | |
| 240 | 45 | | |
| 240 | 60 | | |

| | | |
|--------------------|-------------|------------|
| Average | 316 | 92 |
| Standard deviation | <u>+120</u> | <u>+46</u> |

Wocho

| <u>Volume (cc)</u> | <u>Meat (g)</u> |
|--------------------|-----------------|
| 330 | 95 |
| 310 | 85 |
| 340 | 100 |
| 330 | 59 |

| | | | |
|-----------|------------|------------|--------------------|
| \bar{X} | 238 | 85 | Average |
| S | <u>+13</u> | <u>+18</u> | Standard deviation |

Coconut Data (Waini or Grating Type)

| No. | Weight coconut (g) | Weight of coconut meat (g) | No. | Weight of coconut (g) | Weight of coconut meat (g) |
|--------------------|-----------------------|-------------------------------|------|--------------------------|-------------------------------|
| 1 | 340 | 227 | 29 | 494 | 343 |
| 2 | 397 | 255 | 30 | 416 | 277 |
| 3 | 300 | 205 | 31 | 340 | 236 |
| 4 | 360 | 253 | 32 | 465 | 282 |
| 5 | 446 | 267 | 33 | 490 | 350 |
| 6 | 500 | 312 | 34 | 476 | 280 |
| 7 | 490 | 288 | 35 | 433 | 259 |
| 8 | 280 | 200 | 36 | 346 | 237 |
| 9 | 400 | 250 | 37 | 490 | 306 |
| 10 | 420 | 262 | 38 | 510 | 319 |
| 11 | 460 | 270 | 39 | 496 | 282 |
| 12 | 440 | 293 | 40 | 355 | 237 |
| 13 | 400 | 267 | 41 | 418 | 271 |
| 14 | 480 | 300 | 42 | 455 | 292 |
| 15 | 360 | 225 | 43 | 515 | 303 |
| 16 | 320 | 229 | 44 | 316 | 226 |
| 17 | 380 | 238 | 45 | 296 | 206 |
| 18 | 410 | 263 | 46 | 314 | 209 |
| 19 | 354 | 230 | 47 | 356 | 244 |
| 20 | 395 | 271 | 48 | 294 | 216 |
| 21 | 375 | 257 | 49 | 456 | 275 |
| 22 | 330 | 224 | 50 | 399 | 256 |
| 23 | 440 | 268 | 51 | 482 | 313 |
| 24 | 472 | 311 | 52 | 509 | 299 |
| 25 | 426 | 284 | 53 | 365 | 235 |
| 26 | 386 | 280 | 54 | 492 | 319 |
| 27 | 349 | 253 | 55 | 515 | 334 |
| 28 | 420 | 247 | 56 | 338 | 241 |
| Average | | | 410 | | |
| Standard deviation | | | ± 68 | | |
| | | | 265 | | |
| | | | ± 36 | | |

PANDANUS

| 1. | Pandanus number | Weight (g) before* | Weight (g) after* | Weight (g) of food eaten |
|----|--------------------|-----------------------|----------------------|--------------------------------|
| | 1 | 144 | 93 | 51 |
| | 2 | 165.5 | 98.5 | 67 |
| | 3 | 148.5 | 103.5 | 45 |
| | 4 | 204.5 | 140 | 64.5 |
| | 5 | 139.5 | 83 | 56.5 |
| | 6 | 151 | 107.5 | 43.5 |
| | 7 | 137.5 | 90 | 47.5 |
| | 8 | 139.5 | 88 | 51.5 |
| | 9 | 154 | 107 | 47 |
| | 10 | 157 | 108.5 | 48.5 |
| | 11 | 161 | 109.5 | 51.5 |
| | 12 | 177 | 127 | 50 |
| | 13 | 133.5 | 87 | 46.5 |
| | 14 | 289(double) | 188 | 101 |
| | 15 | 148 | 104 | 44 |
| | 16 | 155.5 | 105.5 | 50 |
| | 17 | 164 | 117.5 | 46.5 |
| | 18 | 189.5 | 131 | 58.5 |
| | 19 | 152 | 109.5 | 42.5 |
| | 20 | 131.5 | 89.5 | 42 |
| | 21 | 160.5 | 113.5 | 47 |
| | 22 | 171.5 | 123 | 48.5 |
| | 23 | 153.5 | 105.5 | 48 |
| | 24 | 142 | 102.5 | 39.5 |
| | 25 | 151 | 105.5 | 45.5 |
| | 26 | 156.5 | 116.5 | 40 |
| | 27 | 151.5 | 115.5 | 36 |
| | 28 | 127.5 | 91.5 | 36 |
| | 29 | 114.5 | 83.5 | 31 |
| | 30 | 134.5 | 82 | 52.5 |
| | 31 | 178 | 132 | 46 |
| | 32 | 186 | 139.5 | 46.5 |
| | 33 | 149 | 131 | 18 |
| | 34 | 168.5 | 122.5 | 46 |
| | 35 | 106 | 69 | 37 |

*weight before + after process known as kilok method of extracting pudding from cooked pandanus

| | | | |
|--------------------|------------|------------|-----------|
| Average | 156 | 106 | 46 |
| Standard deviation | <u>+20</u> | <u>+17</u> | <u>+9</u> |

PANDANUS

| 2. | <u>Pandanus number</u> | <u>Weight before</u> (g) | <u>Weight after</u> (g) | <u>Net consumed</u> (g) |
|-------|----------------------------|------------------------------|-----------------------------|-----------------------------|
| | 1 | 171 | 99 | 72 |
| | 2 | 173 | 114 | 59 |
| | 3 | 175 | 116 | 59 |
| | 4 | 182 | 123 | 59 |
| | 5 | 164 | 101 | 63 |
| | 6 | 143 | 81 | 62 |
| <hr/> | | | | |
| | Average | 168 | 106 | 62 |
| | Standard deviation | <u>+14</u> | <u>+15</u> | <u>+5</u> |

| 3. | <u>Pandanus number</u> | <u>Weight before</u> (g) | <u>Weight after</u> (g) | <u>Net consumed</u> (g) |
|-------|----------------------------|------------------------------|-----------------------------|-----------------------------|
| | 1 | 98 | 63 | 30 |
| | 2 | 94 | 66 | 28 |
| | 3 | 74 | 51 | 23 |
| | 4 | 90 | 64 | 26 |
| | 5 | 85 | 56 | 29 |
| | 6 | 84 | 52 | 32 |
| | 7 | 81 | 51 | 30 |
| | 8 | 84 | 55 | 29 |
| | 9 | 89 | 69 | 20 |
| | 10 | 78 | 52 | 26 |
| | 11 | 88 | 59 | 29 |
| | 12 | 91 | 63 | 28 |
| | 13 | 81 | 55 | 26 |
| <hr/> | | | | |
| | Average | 86 | 58 | 37 |
| | Standard deviation | <u>+7</u> | <u>+6</u> | <u>+3</u> |

BREADFRUIT DATA

| Type | Total wt. (g) | Center (unedible) (g) | Edible wt. (g) | |
|------------------------|---------------|-----------------------|----------------|-----------|
| Batakatak | 1193 | 63 | 1130 | |
| | 964 | 33 | 931 | |
| | 308 | 14 | 294 | |
| | 820 | 30 | 790 | |
| | 1040 | 23 | 1017 | |
| | 440 | 11 | 429 | |
| | 1856 | 51 | 1805 | |
| Average | 903 | 32 | 913 | |
| Standard deviation | ± 51 | ± 19 | ± 497 | |
| | | | | |
| Mejwan (with seeds) | 520 | 23 | 387 | seeds 110 |
| | 490 | 18 | 276 | 96 |
| | 380 | 14 | 264 | 102 |
| | 476 | 19 | 365 | 92 |
| | 505 | 18 | 365 | 122 |
| | 396 | 12 | 289 | 95 |
| | 350 | 15 | 247 | 88 |
| | 412 | 21 | 290 | 101 |
| Average | 441 | 18 | 310 | 41 |
| Standard deviation | ± 64 | ± 4 | ± 56 | ± 11 |

Appendix E

Types of Fish and Methods of Fishing

1. NET FISHING - LONG NET, THROWN NET

| <u>Marshalllese Name</u> | <u>Scientific Name</u> | <u>Island</u> | <u>Method</u> |
|-----------------------------|---|--|-------------------------|
| Ik kadre | A fish <i>Chelon vaigiensis</i> | Rongelap | long net |
| Utot or dibab or wut wot | butterfly fish <i>Chaetodon anriga</i> | Uterik | long net |
| Pajrok | chub or rudder fish <i>Kyphosus vaigiensis</i> | Rongelap, Wotho, Ailuk | |
| Balle | starry flounder <i>Platichthys stellus</i> | Ailuk | long net |
| Jome | goatfish <i>Mulloidichthys auriflamma</i> | Rongelap, Uterik | thrown net |
| Jo | goatfish <i>Mulloidichthys samoensis</i> | Rongelap - long net Rongelap - thrown net Wotho - not specified Ailuk - | |
| Momo | grouper <i>Epinephelus hexagonatus</i> | Rongelap, Ailuk | long net |
| Tinar | small grouper | Ailuk | - |
| Kalemeej | blue spotted grouper <i>Cepahalopholis argus</i> | Ailuk | - |
| Kuro | grouper <i>Epinephelus fuscogultatus</i> | Ailuk | - |
| Ettou | mackerel <i>Trachurops crumepthalmus</i> | Rongelap | thrown net, long net |
| Iool | mullet <i>Crenmugil crenilabis</i> | Rongelap, Wotho | long net |
| Akor | mullet <i>Chelon vaigiensis</i> | Uterik | long and thrown net |
| Tak | needle fish <i>Belone platyura</i> , <i>Raphiobelone robusta</i> | Rongelap, Ailuk | long net |
| Mao or Mera | parrot fish <i>Scarus jonesi/sordidus</i> | Wotho, Ailuk | |

| | | |
|----------------|--|--|
| Lala or Lolo | parrot fish <i>Callyodon pulchellus</i> | Ailuk, Rongelap |
| Ik mouj | white parrot <i>Scarus harid</i> | Ailuk Wotho Uterik - long net |
| Ellek or Mole | rabbit fish <i>Siganus rastratus</i> or <i>poellus</i> | Rongelap - long and thrown net Uterik - long net Wotho Ailuk |
| Ek-Airik | rainbow runner <i>Elagatis bipinnulatus</i> | Uterik - long net |
| Kabro | rock cod <i>Anyperodon leucogrammicus</i> | Ailuk |
| Badet | Sergeant Major <i>Abudefduf stemfasciatus</i> | Wotho |
| --- | moomoa <i>Abudefduf abdominals</i> | Wotho |
| Kwarkwar | Sardines <i>Sardinella</i> sp. | Rongelap - long net |
| Kupkup | skip jack (immature form) <i>Carant lessonii</i> needle fish <i>Belone platyura</i> , <i>Raphiobelene robusta</i> | Ailuk Rongelap - long net |
| Jetaar | snapper <i>Lutjanus kasmira</i> forskal | Ailuk |
| Kur | squirrel fish <i>Holocentrus binotatus</i> /scythraps | Ailuk |
| M̄on | squirrel fish <i>Myripristis berndti</i> | Rongelap Uterik - long net Ailuk |
| Mone or eanrok | sturgeon fish <i>Naso unicornis</i> | Ailuk |

| | | |
|------------|---|---|
| Kupan | banded sturgeon fish <i>Acanthurus triostegus/linnaeus</i> | Rongelap - long and thrown net Uterik - long net Wotho - |
| Tiepdo | black sturgeon fish <i>Acanthurus nigicans</i> | Ailuk |
| Bub | black trigger fish <i>Melichthys ringens</i> | Ailuk, Rongelap |
| Ael | unicorn fish <i>Hepatus divaceus/scheider</i> <u>Bloch</u> | Ailuk |
| --- | orange spot tang <i>Acanthurus olivaraceus</i> | Ailuk |
| Bataklaj | unicorn fish <i>Naso brevirostris</i> | Ailuk |
| Kibu | --- | Uterik - long and thrown net Ailuk |
| Jorot | --- | Uterik - thrown net |
| Akuba | --- | Ailuk |
| Debijdreka | --- | Ailuk |
| Ebil | --- | Ailuk |

2. FISHING LINE*

| <u>Marshallese name</u> | <u>Scientific name</u> | <u>Island</u> |
|-------------------------|---|------------------------|
| Niitwa or Jure | barracuda <i>Sphyraena forsteri</i> | Ailuk, Wotho, Rongelap |
| Lejabwil | bonito <i>Katsuwonus pelamis</i> | Ailuk, Rongelap |
| Koko | dolphin <i>Coryphoena hippurus</i> | Ailuk |
| Al | kingfish | Ailuk, Rongelap |
| Ikaidrik | rainbow runner | Ailuk, Rongelap |
| Jilo | dogtoothed tuna <i>Gymnosarda nuda</i> | Ailuk, Rongelap |
| Bwebwe | tuna <i>Neothunus macropterus</i> | Ailuk, Rongelap |

*method used at oceanside (off the reef)

3. FISHING LINE *

| <u>Marshallese name</u> | <u>Scientific name</u> | <u>Island</u> |
|----------------------------|---|---|
| | caught in deep water by lagoon or ocean | |
| Kuro | grouper <i>Epinephelus fuscagultatus</i> | Ailuk, Rongelap, Uterik, Wotho |
| Lejebjeb | rock grouper or rockhind <i>Epinephulus adscensionis</i> <i>Epinephulus albofasciatus</i> | Ailuk, Rongelap (bottom fishing), Uterik, Wotho |
| Perak | scavanger <i>Lethrinus kollopterus</i> | Ailuk, Rongelap, Uterik |
| Dijin | scavanger <i>Lethrinus variegatus</i> | Ailuk, Rongelap, Wotho |
| Jaro or Ikonbon or Jaap | red snapper <i>Lutjanus gibbus</i> | Ailuk, Wotho, Rongelap (bottom fishing) |
| Jera | squirrel fish <i>Holocentrus</i> sp./ <i>Myrispistis</i> sp. | Ailuk, Uterik |
| Ewae or Loom | streaker <i>Aprion virescens</i> | Ailuk, Uterik, Rongelap |
| Lane or Ikbwij | skip jack <i>Caranx lessoni/crevally</i> | Uterik, Rongelap, Ailuk |
| Bwilak | unicorn sturgeon <i>Naso lituratus</i> | Ailuk |
| Weo | --- | Wotho, Uterik, Ailuk, Rongelap |

*used in deep water (lagoon or ocean)

3. FISHING LINE *

| <u>Marshallese name</u> | <u>Scientific name</u> | <u>Island</u> |
|-------------------------|--|-------------------------|
| At-kadu | A fish <i>Moi polydactylus</i> | Uterik |
| Kanbok | bass <i>Variola louti</i> | Rongelap |
| Kie | big eye or burgy <i>Monotaxis grandoculis</i> | Rongelap, Uterik |
| Dibab | butterfly fish <i>Chaetodon ocellatus</i> | Uterik |
| Pajrok | chub ro rudderfish <i>Kyphosis vaigiensis</i> | Uterik, Rongelap |
| Jojo | flying fish <i>Exocoetidae</i> sp. | Rongelap, Uterik, Ailuk |
| Jo | goatfish <i>Mulloidichthy samoensis</i> | Uterik |
| Jome | goatfish <i>Mulloikichthys samoensis</i> | Uterik |
| Momo | grouper <i>Epinephelus hexagonatus</i> | Rongelap, Uterik, Wotho |
| Pako | ground shark <i>Carcharhinus melanopterus</i> | Uterik, Rongelap |
| Lappo | hogfish <i>Chelinus undulatus</i> | Rongelap, Uterik |
| Iool | mullet <i>Crenmugil crenilabis</i> | Uterik |
| Ikuut | pilot fish <i>Haucrates ductor</i> | Uterik |

3. FISHING LINE *

| | | |
|---------------|--|---|
| Imim | reef triggerfish <i>Balistopus retangulus/oculeatus</i> | Uterik, Rongelap |
| M̄on or Ar̄on | squirrel fish <i>Myristis berndti</i> | Rongelap - trolling |
| Kupkup | skip jack (immature form) <i>Caranx lessonii</i> | Uterik |
| Lojkan | shell fish | Rongelap |
| Jelaar | snapper <i>Lutjanus kasmira/forskal</i> | Uterik, Rongelap |
| Ban | snapper | Rongelap, Wotho |
| Kejwar | --- | Rongelap |
| Lele | triggerfish, <i>Rhinecanthus aculeatus</i> | Wotho, Rongelap - bottom fishing |
| Jebos | --- | Uterik |
| Kibu | --- | Uterik |
| Melij | --- | Rongelap |
| Januron | --- | Wotho |
| Boklim | --- | Wotho, Uterik, Rongelap - bottom fishing |

*used in deep water (lagoon or ocean)

4. FISHING LINE*

| <u>Marshallese name</u> | <u>Scientific name</u> | <u>Island</u> |
|-------------------------|--|-----------------|
| Pajrok | chub ro rudderfish <i>Kyphosus vaigiensis</i> | Ailuk |
| Balle | starry flounder <i>Platichthys stellatus</i> | Ailuk |
| Jo | goatfish <i>Mullaoichthys samoensis</i> | Ailuk |
| Tinar | small grouper <i>Lutjanus kasmira forksal</i> | Rongelap |
| Momo | grouper <i>Epinephelus hexangonatus</i> | Ailuk |
| Kuro | grouper <i>Platyichthys stellus</i> | Ailuk |
| Tak | needlefish <i>Belone platyura</i> , <i>Raphiobelone robusta</i> | Ailuk, Rongelap |
| KupKup | skip jack (immature form) <i>Caranx lessonini</i> | Ailuk |
| Kur | squirrel fish <i>Holocentrus binotatus/scythrops</i> | Ailuk |
| Monor (Aron) | squirrel fish <i>Myristis berndti</i> | Ailuk, Rongelap |
| Kibu | --- | Ailuk |
| Akuba | --- | Ailuk |
| Ebil | --- | Ailuk |

*pole fishing in shallow water

5. SPEARING FISH

| <u>Marshallese name</u> | <u>Scientific name</u> | <u>Islands</u> |
|----------------------------|--|-------------------------|
| Dep or Eddeup | A fish | Uterik |
| Kie | big eye or burgy <i>Monotaxis grandoculis</i> | Rongelap, Uterik |
| Utot or Dibab or Wutwot | butterfly fish <i>Chaetodon onriga</i> | Uterik |
| Kanbök | bass <i>Variola louti</i> | Rongelap |
| Jawe | giant sea bass <i>Promicrops lanceolatus/truncatus</i> <i>Plectropomus truncatus</i> | Rongelap, Uterik |
| Pajrok | chub or rudder fish <i>Kyphosus vaigiensis</i> | Rongelap, Uterik, Wotho |
| Monaknak | file fish <i>Amansis carolge</i> | Uterik |
| Bale | starry flounder <i>Platichthys stellatus</i> | Rongelap, Uterik |
| Jo | goatfish <i>Mulloidichthys samoensis</i> | Uterik, Wotho |
| Jome | goatfish <i>Mulloidichthys samoensis</i> | Uterik |
| Tinar | small grouper <i>Lutjanus kasmira/forskal</i> | Ailuk, Rongelap |
| Momo | grouper <i>Epinephelus hexagonatus</i> | Uterik, Wotho |

continued

5. SPEARING FISH

| | | |
|----------------------|---|-----------------------------------|
| Kuro | grouper <i>Epinephelus adscensionis</i> | Ailuk, Rongelap, Wotho, Uterik |
| Kalemeej | blue spotted grouper <i>Cephalopholis argus</i> | Ailuk, Uterik |
| Lappo | hogfish <i>Cheilinus undulatus</i> | Rongelap, Uterik |
| Lala | parrotfish <i>Callyodon pulchellus</i> | Ailuk, Rongelap |
| Mao or Mera | parrotfish <i>Scarus jonesi/sordidus</i> | Rongelap, Wotho, Uterik, Ailuk |
| Ellek or Mole | rabbitfish <i>Siganau rostratus/puellus</i> | Ailuk, Rongelap, Uterik, Wotho |
| Moramor or mormor | rabbitfish <i>Siganus sp.</i> | Rongelap |
| Kabro | rock cod <i>Anyperodon leucogrammicus</i> | Ailu, Rongelap |
| Lojebjeb | rock hind <i>Epinephelus albofasciatus</i> | Uterik, Wotho, Rongelap |
| --- | grouper <i>Epinephelus adscensionis</i> | Uterik |
| Perak | scavanger <i>Lethrinus kollapterus</i> | Uterik |
| Mon or Moned | squirrel fish <i>Myripristis berndti</i> | Uterik |
| Jera | squirrel fish <i>Holocentrus sp./Myripristis sp.</i> | Rongelap, Uterik |

continued

5. SPEARING FISH

| | | |
|--------------------|--|------------------------|
| Badet | sergeant major Abudefduf | Wotho |
| Jetaar (Jetaad) | snapper Lutjanus kasmire/forskal | Ailuk, Rongelap |
| Bonej | snapper Lutjanus vitta | Uterik |
| Iool | mullet Crenmugil crenilabis | Wotho |
| Tiepdo | black surgeonfish Acanthurus nigricans | Ailuk |
| Kupan | banded surgeonfish Acanthurus triostegus/linnaeus | Wotho, Uterik |
| Mone eanrok | surgeonfish Naso unicornis | Rongelap, Uterik |
| Imim | reef triggerfish Balistapus retangulas/aculeatus | Rongelap, Uterik |
| Bub | black triggerfish Melichthys ringens | Ailuk |
| Lele | triggerfish Rhinecanthus aculeatus | Rongelap |
| Baraklaj | unicorn fish Naso brevirostris | Ailuk |
| Ael | unicorn fish Hepatus olivaceus/schneider <u>Bloch</u> | Rongelap, Ailuk, Wotho |
| --- | orange spot tang Acanthurus divaceus | Ailuk |

continued

5. SPEARING FISH

| | | |
|------------|-------------------------------------|-----------------------------------|
| Bwilak | unicorn - surgeon Naso lituratus | Rongelap, Uterik |
| Ik mouj | white parrot Scarus harid | Ailuk, Rongelap, Uterik, Wotho |
| Jiborbor | --- | Rongelap |
| Kibuj | --- | Uterik |
| Jonuron | --- | Wotho |
| Boklim | --- | Wotho, Rongelap |
| Ieo | --- | Uterik |
| Ikenae | --- | Wotho |
| Pebijdreka | --- | Ailuk |
| Karlas | --- | Uterik |

RONGELAP

Fish poisoning from

imim - reef fish, trigger fish
Balistapus retangulus/oculeatus

jaliia - a fish scavanger, Lethrinus miniatus

jowe - giant sea bass, Promicrops lanceolatus/truncatus
bass, Plectropomus truncatus

iool - mullet, Crenmugil crenilabis

WOTHO

Fish poisoning from

mao
ekmouj
iōl
ael
lele
ikenae

Appendix F

School Children's Feeding Program

1. The school children's feeding program requires that each child should receive:

Type A Menu

Breakfast

Fruit - 1/2 cup
or
Fruit juice - 1 cup
Bread - 1 slice
Milk - 1 cup
Meat - 1 ounce (optional)

Lunch

Meat - 2 ounces
Fruit and vegetables - 3/4 cup
Milk - 1 cup
Bread - 1 slice
Butter - 1/2 teaspoon (optional)

Substitutions:

For meat we can use any canned meat, fish, pork, chicken, shell fish, jokra, clams, turtle, eggs, and peanut butter.

Instead of bread we can use 1/2-3/4 cup of rice, taro, breadfruit, coconut meat, bananas.

Fruit and vegetables can be any of the canned fruits and vegetables, papaya, pumpkin, taro leaves, sweet potato, Chinese cabbage.

Note: Each school is allowed \$100/month for purchase of local food.

2. Lunch program as carried out at the different Atolls/islands.

- a. Number of school days a week - 5
- b. Number of school days a year - 210
- c. Items and quantities

I: Breakfast

| <u>Basic</u> | <u>Substituted by</u> | <u>Amount</u> |
|--|--|--|
| 1. Fruit or Fruit juice | Fruit cocktail, peaches apple sauce, pineapple orange, grape, apple | 57 g 240 cc |
| 2. Bread or Rice | flour macaroni, oatmeal or taro, breadfruit, coconut meat, bananas | 30 g 115-200 g (cooked weight) |
| 3. Milk (powdered) | --- | 230 g |
| 4. Sugar | --- | 15-30 g |
| 5. Meat (canned) (fresh) or Fish (canned) or Fish (fresh) | eggs (processed), peanut butter, spam, beef stew, chicken, pork mackerel, tuna or fish, turtle, shellfish | 30 g |

II. Lunch

| <u>Basic</u> | <u>Substituted by</u> | <u>Amount</u> |
|--|--|---|
| a. Meat - canned <u>or</u> - fresh* <u>or</u> Fish - canned <u>or</u> - fresh* | spam, beef stew, pork, chicken mackerel, tuna fish, shellfish, turtle <u>or</u> peanut butter | 57 g |
| b. Fruit and vegetable | Fruit cocktail, peaches applesauce, pineapple <u>or</u> mixed vegetables, peas, tomatoes, corn, greenbeans | 57-85 g |
| c. Milk | --- | 240 cc |
| d. Bread <u>or</u> Oatmeal <u>or</u> Rice | --- taro, breadfruit coconut meat, bananas | 29 g 114-170 g 114-170 g (cooked weight) |
| e. butter | --- | 8 g |

Appendix G
Typhoon Relief
Family Distribution Guides for Donated Commodities

| COMMODITY | UNIT | PER PERSON/MONTH | Number of persons in family | | | | | | | | | | | |
|---------------------|------------|--------------------------|-----------------------------|---|----|---|----|---|----|---|----|---|----|---|
| | | | 1 | : | 2 | : | 3 | : | 4 | : | 5 | : | 6 | : |
| BUTTER/MARGARINE | 3# CN | 1# (1 LB) 454 g | 1 | : | 1 | : | 1 | : | 2 | : | 2 | : | 2 | : |
| POULTRY CANNED | 29 OZ. | 1 CN (29 OZ) 830 g | 1 | : | 2 | : | 3 | : | 4 | : | 5 | : | 6 | : |
| BEEF CANNED | 29 OZ. | 1 CN (29 OZ) 830 g | 1 | : | 2 | : | 3 | : | 4 | : | 5 | : | 6 | : |
| EGG MIX | 6 OZ. | 1 PKG (6 OZ) 170 g | 1 | : | 2 | : | 3 | : | 4 | : | 5 | : | 6 | : |
| FLOUR A/P | 10# PKG | 5# (5 LBS) 2290 g | 1 | : | 1 | : | 2 | : | 2 | : | 3 | : | 3 | : |
| ORANGE JUICE | 46 FL OZ. | 1 CAN (46 FL OZ) 1380 cc | 1 | : | 2 | : | 3 | : | 4 | : | 5 | : | 6 | : |
| PEAS CANNED | #303 CN | 1 CAN (1 lb) 454 g | 1 | : | 2 | : | 3 | : | 4 | : | 5 | : | 6 | : |
| BEANS CANNED | #303 CN | 1 CAN (1 lb) 454 g | 1 | : | 2 | : | 3 | : | 4 | : | 5 | : | 6 | : |
| MILK EVAPORATED | 14.5 OZ CN | 1 CAN (14.5 OZ) 435 cc | 1 | : | 2 | : | 3 | : | 4 | : | 5 | : | 6 | : |
| MILK INSTANT | 4# PKG | 1# (1 LB) 454 g | 1 | : | 1 | : | 1 | : | 1 | : | 2 | : | 2 | : |
| PEANUT BUTTER | 2# CN | 1# (1 LB) 454 g | 1 | : | 1 | : | 2 | : | 2 | : | 3 | : | 3 | : |
| MACARONI | 1# PKG | 1 PKG (1 LB) 454 g | 1 | : | 2 | : | 3 | : | 4 | : | 5 | : | 6 | : |
| SHORTENING | 3# CN | 1# (1 lb) 454 g | 1 | : | 1 | : | 1 | : | 2 | : | 2 | : | 2 | : |
| CORN SYRUP | 16 FL OZ | 1 BTL (16 FL OZ) 480 cc | 1 | : | 2 | : | 3 | : | 4 | : | 5 | : | 6 | : |
| RICE | 2# PKG | 20# (20 LBS) 9080 g | 10 | : | 20 | : | 30 | : | 40 | : | 50 | : | 60 | : |
| POTATOES DEHYDRATED | 1# PKG | 1 PKH (1 LB) 454 g | 1 | : | 2 | : | 3 | : | 4 | : | 5 | : | 6 | : |
| CORN CANNED | 24/#303 CN | 1 CAN (1 lb) 454 g | 1 | : | 2 | : | 3 | : | 4 | : | 5 | : | 6 | : |

Source: Trust Territory (Majuro)

Appendix H

Food Supply Ships - Trip Schedule
(as carried out during 1977-1978)

| MONTH | SOUTHERN ATOLLS | WESTERN ATOLLS | EASTERN ATOLLS | CENTRAL ATOLLS | NORTHERN ATOLLS |
|-------|--|----------------|----------------|-------------------------------|--|
| OCT | 1- FTS | 1- FTS | -0- | 2- FTS | 1- FTS |
| NOV | 1- FTS | -0- | 2- FTS | 1- FTS | 1- FTS |
| DEC | 2- FTS | 1- FTS | -0- | -0- | 1- FTS |
| JAN | -0- | 1- FTS | -0- | -0- | 1- FTS |
| FEB | 1- Spc | -0- | -0- | 1- FTS | 2- FTS |
| MAR | 1- Spc, 1- FTS | 1- FTS | -0- | 1- FTS | -0- |
| APR | 1- FTS | -0- | 2- FTS | 1- FTS | 1- FTS |
| MAY | 1- Spc-Kili, 1- FTS, 1- Spc-Kili | 1- FTS | -0- | -0- | 1- FTS |
| JUN | 2- FTS | 1- FTS | 1- FTS | 1- FTS | 1- Spc |
| JUL | 1- FTS, 1- Spc 1- Spc-Kili | 1- FTS | 1- FTS | 1- UN Mission 1- B-Pick up | 1- Spc 1- FTS |
| AUG | 1- Spc, Kili, Jabor 1- Kili, 2- FTS | -0- | 2- FTS | 1- FTS | 1- FTS |
| SEP | 1- Spc, Jabor-Kili | 1- FTS | 1- FTS | 2- FTS | 1- FTS |
| OCT | <u>1- FTS</u> | <u>1- FTS</u> | <u>1- FTS</u> | <u>1- FTS</u> | <u>1- FTS, 1-Spc, Utirik, Rongelap</u> |
| | 13 - FTS 7- Spc | 9- Regular | 10-Regular | 11-Regular 2-Special | 11-Regular 2-Special |

Appendix I
Private or Community Stores
Types of Food Available*

| | | | |
|---------------|-------------|-----------------|--------------|
| Rice | Corned beef | Tang | Shoyu |
| Flour | Tuna | Milk (powdered) | Shortening |
| Sugar | Sardines | Coffee | Iodized salt |
| Yeast | Mackerel | Tea | |
| Biscuit | | Milk (canned) | |
| Peanut butter | | Baby food | |